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PREFACE

In this volume, being the Economic volume of 'The Indian Empire,' chapter i, on Agriculture, is based on materials supplied by Mr. J. W. Mollison, Inspector-General of Agriculture; chapter ii, on Forests, was written by Mr. S. Eardley-Wilmot, Inspector-General of Forests; chapter iii, on Mines and Minerals, by Mr. T. H. Holland, F.R.S., Director of the Geological Survey; chapter iv, on Arts and Manufactures, is based on materials supplied by Sir George Watt, C.I.E., late Reporter on Economic Products; chapter v, on Commerce and Trade, is based on materials supplied by Mr. J. E. O'Conor, C.I.E., late Director-General of Statistics; chapter vi, on Irrigation and Navigation, was written by Sir Thomas Higham, K.C.I.E., late Inspector-General of Irrigation; in chapter vii, 'Railways' was written by Mr. N. G. Priestley, Secretary to the Railway Board, and 'Roads' by the late F. B. Hebbert; chapter viii, on Posts and Telegraphs, was written by Mr. H. M. Kisch, C.S.I., with assistance from Mr. F. G. Maclean, C.I.E., and Sir Sidney Hutchinson, successive Directors-General of Telegraphs; in chapter ix, 'Rents' was written by Mr. E. D. Maclagan, and 'Wages and Prices' by Mr. J. A. Robertson; chapter x, on Famine, by Mr. S. H. Butler, C.I.E.

INTRODUCTORY NOTES

Notes on Transliteration

Vowel-Sounds

a has the sound of *a* in 'woman.'
ā has the sound of *a* in 'father.'
e has the vowel-sound in 'grey.'
i has the sound of *i* in 'pin.'
ī has the sound of *i* in 'police.'
o has the sound of *o* in 'bone.'
u has the sound of *u* in 'bull.'
ū has the sound of *u* in 'flute.'
ai has the vowel-sound in 'mine.'
au has the vowel-sound in 'house.'

It should be stated that no attempt has been made to distinguish between the long and short sounds of *e* and *o* in the Dravidian languages, which possess the vowel-sounds in 'bet' and 'hot' in addition to those given above. Nor has it been thought necessary to mark vowels as long in cases where mistakes in pronunciation were not likely to be made.

Consonants

Most Indian languages have different forms for a number of consonants, such as *d*, *t*, *r*, &c., marked in scientific works by the use of dots or italics. As the European ear distinguishes these with difficulty in ordinary pronunciation, it has been considered undesirable to embarrass the reader with them; and only two notes are required. In the first place, the Arabic *k*, a strong guttural, has been represented by *k* instead of *q*, which is often used. Secondly, it should be remarked that aspirated consonants are common; and, in particular, *dh* and *th* (except in Burma) never have the sound of *th* in 'this' or 'thin,' but should be pronounced as in 'woodhouse' and 'boathook.'

Burmese Words

Burmese and some of the languages on the frontier of China have the following special sounds :—

aw has the vowel-sound in 'law.'
ö and ü are pronounced as in German.
gy is pronounced almost like *j* in 'jewel.'
ky is pronounced almost like *ch* in 'church.'
th is pronounced in some cases as in 'this,' in some cases as in 'thin.'
w after a consonant has the force of *uw*. Thus, *ywa* and *pwe* are disyllables, pronounced as if written *yuwa* and *puwe*.

It should also be noted that, whereas in Indian words the accent or stress is distributed almost equally on each syllable, in Burmese there is a tendency to throw special stress on the last syllable.

General

The names of some places—e.g. Calcutta, Bombay, Lucknow, Cawnpore—have obtained a popular fixity of spelling, while special forms have been officially prescribed for others. Names of persons are often spelt and pronounced differently in different parts of India; but the variations have been made as few as possible by assimilating forms almost alike, especially where a particular spelling has been generally adopted in English books.

NOTES ON MONEY, PRICES, WEIGHTS AND MEASURES

As the currency of India is based upon the rupee, all statements with regard to money throughout the *Gazetteer* have necessarily been expressed in rupees, nor has it been found possible to add generally a conversion into sterling. Down to about 1873 the gold value of the rupee (containing 165 grains of pure silver) was approximately equal to 2*s*., or one-tenth of a £; and for that period it is easy to convert rupees into sterling by striking off the final cipher (Rs. 1,000 =£100). But after 1873, owing to the depreciation of silver as compared with gold throughout the world, there came a serious and progressive fall in the exchange, until at one time the gold value of the rupee dropped as low as 1*s*. In order to provide a remedy for the heavy loss caused to the Government of India in respect of its gold payments to be made in England, and also to relieve foreign trade and finance from the inconvenience due to constant and unforeseen fluctuations in exchange, it was resolved in 1893 to close the mints to the free coinage of silver, and thus force up the value of the rupee by restricting the circulation. The intention was to raise

the exchange value of the rupee to 1*s*. 4*d*., and then introduce a gold standard (though not necessarily a gold currency) at the rate of Rs. 15 = £1. This policy has been completely successful. From 1899 onwards the value of the rupee has been maintained, with insignificant fluctuations, at the proposed rate of 1*s*. 4*d*.; and consequently since that date three rupees have been equivalent to two rupees before 1873. For the intermediate period, between 1873 and 1899, it is manifestly impossible to adopt any fixed sterling value for a constantly changing rupee. But since 1899, if it is desired to convert rupees into sterling, not only must the final cipher be struck off (as before 1873), but also one-third must be subtracted from the result. Thus Rs. 1,000 = £100 − $\frac{1}{3}$ = (about) £67.

Another matter in connexion with the expression of money statements in terms of rupees requires to be explained. The method of numerical notation in India differs from that which prevails throughout Europe. Large numbers are not punctuated in hundreds of thousands and millions, but in lakhs and crores. A lakh is one hundred thousand (written out as 1,00,000), and a crore is one hundred lakhs or ten millions (written out as 1,00,00,000). Consequently, according to the exchange value of the rupee, a lakh of rupees (Rs. 1,00,000) may be read as the equivalent of £10,000 before 1873, and as the equivalent of (about) £6,667 after 1899; while a crore of rupees (Rs. 1,00,00,000) may similarly be read as the equivalent of £1,000,000 before 1873, and as the equivalent of (about) £666,667 after 1899.

Finally, it should be mentioned that the rupee is divided into 16 annas, a fraction commonly used for many purposes by both natives and Europeans. The anna was formerly reckoned as 1½*d*.; it may now be considered as exactly corresponding to 1*d*. The anna is again subdivided into 12 pies.

The various systems of weights used in India combine uniformity of scale with immense variations in the weight of units. The scale used generally throughout Northern India, and less commonly in Madras and Bombay, may be thus expressed: one maund = 40 seers; one seer = 16 chittaks or 80 tolas. The actual weight of a seer varies greatly from District to District, and even from village to village; but in the standard system the tola is 180 grains Troy (the exact weight of the rupee), and the seer thus weighs 2·057 lb., and the maund 82·28 lb. This standard is used in official reports and throughout the *Gazetteer*.

For calculating retail prices, the universal custom in India is to express them in terms of seers to the rupee. Thus, when prices change, what varies is not the amount of money to be paid for the

same quantity, but the quantity to be obtained for the same amount of money. In other words, prices in India are quantity prices, not money prices. When the figure of quantity goes up, this of course means that the price has gone down, which is at first sight perplexing to an English reader. It may, however, be mentioned that quantity prices are not altogether unknown in England, especially at small shops, where pennyworths of many groceries can be bought. Eggs, likewise, are commonly sold at a varying number for the shilling. If it be desired to convert quantity prices from Indian into English denominations without having recourse to money prices (which would often be misleading), the following scale may be adopted—based upon the assumptions that a seer is exactly 2 lb., and that the value of the rupee remains constant at 1*s.* 4*d.*: 1 seer per rupee = (about) 3 lb. for 2*s.*; 2 seers per rupee = (about) 6 lb. for 2*s.*; and so on.

The name of the unit for square measurement in India generally is the *bīgha*, which varies greatly in different parts of the country. But areas have always been expressed throughout the *Gazetteer* either in square miles or in acres.

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THE INDIAN EMPIRE

VOLUME III

ECONOMIC

CHAPTER I

AGRICULTURE

I. Agricultural Population, Climate, and Soils

Proportion of the population engaged in agriculture.

THE predominating feature of agriculture in India is that it gives occupation, directly and indirectly, to an immense majority of the population of the country. The census returns show that in British Provinces the proportion of the total population directly engaged in agriculture was 62 per cent. in 1891 and 68 per cent. in 1901, the corresponding figures for Native States in those years being 57 and 60 per cent. In India as a whole about 175,000,000 people were directly dependent upon agriculture proper and cattle-rearing in 1891, and 196,000,000 in 1901, the total population of the country in those years being 287,000,000 and 294,000,000 respectively. The following table gives detailed statistics for 1901, as recorded in the occupation returns of the Census:—

Number of Persons subsisting from	British India.	Native States.	Total.
Provision and care of animals.			
Stock-breeding and dealing .	2,745,486	1,159,183	3,904,669
Training and care of animals .	57,058	14,904	71,962
TOTAL . .	2,802,544	1,174,087	3,976,631
Agriculture.			
Landholders and tenants . .	122,727,972	29,956,276	152,684,248
Agricultural labourers . .	30,310,064	5,098,774	35,408,838
Growers of special products .	1,783,660	844,960	2,628,620
Agricultural training and supervision	856,269	113,756	970,025
TOTAL . .	155,677,965	36,013,766	191,691,731
GRAND TOTAL	158,480,509	37,187,853	195,668,362

The rural population nearly entirely agricultural.

In addition to the classes above enumerated, the village communities contain many other members whose employment depends on the cultivator, and who are therefore ordinarily supported from the produce of the village fields. Many persons too combine agriculture, as a subsidiary pursuit, with some other occupation. It has been estimated that nine-tenths of the rural population of India live, directly or indirectly, by agriculture.

Increase of landless labourers.

A comparison of the census returns of 1891 and 1901 shows that the classes enumerated in the foregoing table increased during ten years approximately as follows :—

Cattle-breeders and attendants	331,000
Landowners and tenants	2,753,000
Labourers	16,736,000
Growers of special products	367,000
Supervisors of estates, &c.	100,000

The number of agricultural labourers nearly doubled. The increase is largely due to changes in classification ; but a considerable landless class is developing which involves economic danger, because the increase has been most marked in districts where the rural population is already congested or in Provinces in which there is special liability to periodic famine. Even in normal seasons the ordinary agricultural labourers in some tracts earn a poor and precarious livelihood. They are employed on the land only during the busy seasons of the year, and in slack times a few are attracted to large trade centres for temporary work. As trade industries develop this attraction to towns will increase. Generally speaking, however, the Indian peasant clings to the neighbourhood of his own home, however much it may be overcrowded.

Land available in sparsely populated tracts.

There is still plenty of land in India for the whole of the rural people. Good agricultural dry-crop land lies waste, notably in Central India and the Central Provinces, because there are not enough people or cattle for cultivation. In other parts (particularly in the Deccan), with a climate at least equally precarious, cultivation has extended from the best to the very poorest descriptions of soil. The cultivators of these poorer soils make only a bare living in favourable seasons, and, with their dependants, flock to relief works in famine years. Agricultural labourers migrate from Bengal and the Central Provinces to Assam, from the United Provinces to Bengal, from Madras and Chittagong to Burma ; and, outside of India, to Ceylon, Mauritius, South Africa, British Guiana, and other colonies in search of agricultural or other employment. But, speaking generally, migration or emigration has worked

hitherto on such a small scale in India as a whole that little relief has been given to either congested or sparsely populated districts. The movement between different parts of India is usually of a temporary nature, and does not involve a permanent change of residence. A great deal of land in the Punjab and Sind has, however, been brought under canal irrigation within recent years, and has been colonized by people from thickly inhabited tracts. There is evidence that this migration will increase with the future extension of canals in the Punjab. The census returns of this Province for 1901 show more than 10,000,000 landowners and tenants, and only 360,000 labourers.

Proportion of cropped area, cultivable waste, and forests.

General statistics regarding cultivation in British India in 1903-4 will be found in Table I at the end of this chapter. The table below gives for the same year the percentages to total area of (*a*) net cropped area, (*b*) cultivable waste other than current fallow, and (*c*) forests in the eight principal Provinces.

Provinces.	Percentage to Total Area of		
	Net cropped area.	Cultivable[1] waste other than fallow.	Forests.
Madras	41·7	8·8	19·5
Bombay	37·0	10·8	10·7
Bengal	50·0	12·8	5·4
United Provinces	53·7	16·3	13·9
Punjab	43·6	31·5	6·1
Burma	12·1	22·4	11·5
Central Provinces and Berār	39·9	24·6	21·7
Assam	26·8	42·4	13·1

Meteorological conditions affecting agriculture.

Meteorologically India consists of two portions. The first lies between the Himālayas and the Vindhyas, and is chiefly occupied by the plains of the Ganges and Indus and their tributaries. It will be referred to hereafter as Northern India. The other portion lies to the south of the Vindhyas, and will be styled Peninsular India.

Two harvests—the *kharīf* and the *rabi*.

The cultivation of the staple crops in different districts is to some extent determined by the character of the soil, but to a greater extent by rainfall and other climatic conditions, such as deposition of dew, temperature during the growing seasons, and dampness in the air. There are two main harvests—the *kharīf* and the *rabi*. The agricultural year may be further divided into four periods, viz.: June to October, corresponding roughly with the period of the south-west monsoon proper;

[1] Waste classified as cultivable includes much land which could not be cultivated profitably at existing prices of crops.

November and December, months of the retreating south-west monsoon; the cold-weather months of January and February; and the hot-weather months from March to May. Each period is not, however, strictly confined to the months named. The sowing of *kharīf* (autumn) crops begins with the first rains of the south-west monsoon, usually in June, and in normal seasons extends well into July. The various *kharīf* crops are reaped between September and December. *Rabi* (spring) crops differ in kind from the *kharīf* crops and require less rainfall, but in the north of India they derive great benefit from dew. They are sown usually in October and November, and ripen in March and April. During their period of growth they are subject to a considerable degree of cold, which limits the choice of staples. The difference in character between *kharīf* and *rabi* crops is most marked where, as in Northern India, there are great variations in temperature at different seasons of the year. In Madras, where the climate is marked by more regular and continuous warmth, these distinctions largely disappear, and there are only early and late sowings of the same crops.

The monsoons.

No one without Indian experience can realize the anxieties which are felt annually regarding monsoon prospects. The south-west monsoon supplies the greatest part of India's rainfall, and the prosperity of the peasant in any particular year depends upon this rainfall being tolerably normal in amount and seasonably distributed. Some parts of India suffer as often from excessive as from deficient rainfall, but not of course so severely. The influence of the south-west monsoon extends throughout the whole of India and Burma, but is unequally beneficial. The western half of Peninsular India, including nearly the whole of Bombay, is practically dependent upon this rainfall. *Kharīf* crops are therefore most important in these parts.

What is popularly called the north-east monsoon, but is really the south-west monsoon in retreat[1], gives to the south-east of the Peninsula its heaviest rainfall between October and December. It also gives rain to the southern parts of the Hyderābād State, and as far north as the Southern Marāthā country in Bombay. The chief sowings of 'dry' crops in the tracts affected are in September and October. The showers which occur from October to December in the Central Provinces, Berār, and the north of Hyderābād are also connected with this monsoon. Though usually small in amount, they are of great value on the black soils suitable for *rabi* crops of wheat, linseed, and gram.

[1] See Vol. I, chap. iii, Meteorology.

In Northern India the rain from the south-west monsoon gives the conditions necessary for the growth of varied *kharīf* crops, while the weather from November to March, usually bright and dry with occasional light showers of rain, is well suited to the *rabi*. The extreme north-western areas obtain about half their average rainfall in the winter months, during which also the plains of the Punjab, the north-western districts of the United Provinces, and the submontane districts receive rain which is sometimes heavy. Lighter winter rain also extends less frequently into the remainder of the United Provinces and to Bihār. Winter and hot-weather rains.

In Bengal, Assam, and Burma, the rainfall is considerable between March and May, and for this reason general sowings of various crops take place earlier than in other parts of India. The Bombay Presidency and the plains of north-western India receive practically no rain in the hot-weather months. In Southern India 'mango showers,' amounting at most to a few inches, fall in this period.

The areas in India which receive heavy rainfall, and in which the chances of serious failure in any year are remote, are Eastern and Lower Bengal, Assam, Burma, and the coast strip between the Western Ghāts and the Arabian Sea, from the extreme south of the Peninsula to the southern boundary of Surat District. Upper Burma has a small dry zone, but the Province as a whole enjoys a copious and assured rainfall. The heavy rainfall areas have an average annual fall of at least 70 inches, and in many places the average is much higher. At Cherrapunji, in the Khāsi Hills of Assam, for instance, the recorded average is about 460 inches. One inch of rain over an acre of ground weighs approximately 101 tons. The heavy rainfall areas therefore receive annually 7,000 tons or more of rain per acre. Rice is the chief crop grown in these tracts; but jute is also important in Bengal, and tea in Assam. Areas of heavy and light rainfall.

Cultivation without irrigation is exceedingly precarious if the annual rainfall is less than 10 or 12 inches; and in parts of Sind, Rājputāna, and the Punjab rainfall is very slight or nominal. In such tracts, and in the desert parts of north-western India, the land in its natural condition produces scrub growth and grazing of a kind, which gives some food to cattle, sheep, goats, and camels.

The areas which are rendered secure by irrigation are those served by the large canal systems of the north of India and the Madras deltas, which depend upon great rivers for their water-supplies, and those supplied by ample irrigation from wells. Outside the areas thus protected and the zones of heavy rain- Areas immune from, or specially subject to, famine.

fall already referred to, there are nearly a million square miles in other parts of India which are not safe against the uncertainties of the seasons and the risk of famine. The annual rainfall in many parts is liable to extraordinary variations, and the effects of great deficiency depend on the quality of the soil and the classes of crops cultivated. The parts which are most liable to drought or famine are the recognized famine zones in the plateau of Peninsular India, with an average rainfall of about 30 inches or less. Other tracts of higher average rainfall, as, for instance, Gujarāt, Mālwā, and parts of the Central Provinces, have at times suffered intensely from famine. To give immunity the rainfall must be not only sufficient on an average of years, but also well distributed.

General efficiency of the peasant as cultivator.

Throughout India the soils, the seasons, the local conditions, and agricultural practices vary in an extraordinary degree. The variety of ordinary field and garden crops is greater than in any other country in the world. Crops are normally sown and harvested in various parts in every month of the year, and, generally speaking, the inherited experience of generations enables the ryots to cultivate their small holdings very skilfully. 'At his best,' says Dr. Voelcker in chapter ii of his *Report on the Improvement of Indian Agriculture*, 'the Indian ryot or cultivator is quite as good as, and in some respects the superior of, the average British farmer, while at his worst it can only be said that this state is brought about largely by an absence of facilities for improvement which is probably unequalled in any other country; and that the ryot will struggle on patiently and uncomplainingly in the face of difficulties in a way that no one else would. . . . The native, though he may be slow in taking up an improvement, will not hesitate to adopt it if he is convinced that it constitutes a better plan and one to his advantage.' There are, however, good and bad farmers in India just as in other countries. Hereditary skill in cultivation is not nearly so developed in some castes as in others; thus Rājputs, Brāhmans, and Kolīs are, generally speaking, inferior as cultivators to Jāts, Kurmīs, and Kāchīs. In places the ordinary cultivation is indifferent and wasteful; and, speaking generally, farming in some parts of India, as in Gujarāt, is much more advanced than in others, e.g. the Central Provinces. It follows that a hopeful field for improvement lies in the interchange between districts or Provinces of superior indigenous methods, implements, or varieties of crops. In particular parts of India cultivation of the very highest order exists which is associated with irrigation from

wells. If the depth of water is considerable, the cost of lifting it is high, and therefore only good crops will pay. In Bombay and Madras, and generally throughout Peninsular India, the principles of manuring and rotation, and the need of thorough tillage, are perfectly understood and practised on the scattered areas under well-irrigation. Crops are taken in rapid succession, the land being usually double-cropped each year. Indigenous implements and water-lifts of cheap primitive construction are used. They are entirely suitable to this garden cultivation, which, especially in parts of Gujarāt, cannot, in respect of neatness and thoroughness, be excelled by the best gardeners or best farmers in any other part of the world. Cultivation of this sort will spread by the force of good example; but, requiring, as it does, a large amount of capital for extra labour, cattle, manure, and other contingent expenses, it must always be small in extent in comparison with the more ordinary cultivation which, in the different Provinces, is carried out with infinite variety of detail. These variations are so great that it is beyond the scope of the present chapter to contrast them except in a cursory way.

The peasant's assiduity.

Nowhere is greater industry shown than by the hardy hillmen who cultivate terraced patches on the slopes of the foot-hills of the Himālayas. The initial cost of terracing and preparing land for cultivation in these situations was enormous, and has nevertheless been remunerative. The land in the best positions is naturally rich, and is annually fertilized by the wash from higher slopes, while there are facilities for irrigation from springs and hill streams. The rainfall is almost assured, and two crops are commonly grown in a year. An astonishing amount of labour is required for cultivation, and in carrying manure to the fields or produce to the homesteads and to market. The transport along precipitous bridle-paths by pack animals, and by the people themselves, has to be seen to be realized. The hill cultivator, however, works in a favourable climate. It is less easy to understand the extraordinary diligence of the ordinary cultivator in the plains, who has to labour under climatic conditions which are exceptionally trying at certain seasons of the year. The arduous character of manual and bullock-power labour is most marked in rice cultivation, particularly in the deltaic areas of Bengal, Burma, and Madras, and in the tracts of heavy rainfall in Bombay, the Central Provinces, and elsewhere. The preparatory tillage and the sowing, planting, and weeding are done while the land is in the condition of a swamp. Labour is carried on in other tracts

under easier circumstances; but the husbandman and his dependants have to work hard at most seasons, whether their simple methods of cultivation are applied to dry or irrigated crops. The area which a man with a pair of bullocks can actually cultivate varies with circumstances. On an average a pair of bullocks is required for 2 or 3 acres of irrigated 'garden' cultivation, for 5 or 6 acres of rice, for 6 to 10 acres of partly irrigated and partly dry alluvial land in the north of India, and for 25 to 40 acres in the dry uplands of the Carnatic or the black-soil plains of the Deccan. In most parts of India the peasant's leisure season comes with the hot weather, after his grain has been threshed out by the feet of his cattle and winnowed in the breeze.

Soils.

In respect of different geological types of soil, India exhibits far less variation than England; still the main varieties of soils are so numerous that it is beyond the scope of this chapter to classify and describe them. An effort will be made, however, to indicate the broader differences characterizing the chief kinds obtained from the three principal geological formations.

Alluvial tracts.

The alluvial tracts are the most extensive, and agriculturally the most important. They occupy the greater portions of Sind, Gujarāt, Rājputāna, the Punjab, the United Provinces, Bengal, and the Godāvari, Kistna, and Tanjore Districts of Madras, besides extensive tracts in Assam and Burma. An alluvial strip of varying width extends along the eastern and western coasts of the Peninsula, widening at the deltas of the great rivers, and reaching irregularly into the valleys of the Eastern and Western Ghāts. Rich alluvial soils fringe the courses of the great rivers of Peninsular India in many places.

The alluvial soil of the Kistna and Godāvari deltas is a dark-coloured loam. In the Indo-Gangetic plains the colour of the surface soil may be any shade between light fawn and brown. The soils vary in consistence from drift sands to clays so stiff that drainage is entirely prevented, and in certain cases injurious salts of soda and magnesia accumulate, which appear as an efflorescence (*reh*) on the surface of the sterile soil. Soils in Bengal are distinctly lighter in colour and denser than those in north-western India. The latter have particles in a fine state of division, but may contain nodular limestone or *kankar*, found in beds or layers at various depths. The soil may extend, unaltered in colour and consistence, to a considerable depth; but commonly substrata are found in well-defined layers of sand, clay, and loam. The depth to subsoil water is in many places very moderate, but in some parts of

the Punjab and the United Provinces the wells are deep. Alluvial soils which are not too dense in consistence, and are naturally drained, can be irrigated with great advantage, the surface being usually flat or only slightly undulating. With moderate and well-distributed rainfall, the alluvial soils of the Indo-Gangetic plains are capable of growing a great variety of *kharīf* and *rabi* crops, for the depth of soil secures great natural fertility. The amounts of nitrogen and organic matter in alluvial soils vary, but are generally low. The potash is adequate, and the phosphoric acid, though not plentiful, is generally less deficient than in other classes of Indian soils. Lime and magnesia appear to be sufficient in amount, while the proportions of iron and alumina are high, particularly in the heavier clay loams.

The Deccan trap formation, which extends over about 200,000 square miles, covers the greater portion of the Bombay Presidency, the whole of Berār, the western third of the Central Provinces, and the western half of Hyderābād. The soils throughout this area vary to an extraordinary extent in character and productiveness. Scattered throughout the tracts in question are numerous low trap hills and ridges connected with the Western Ghāts and Sātpurā ranges, while the cultivated lands are to a large extent broken and rolling. On the slopes and uplands of the lower trap hills the soils are thin and poor. The disintegrated trap furnishes a light-coloured sandy or gravelly soil, which is moderately productive only in years of favourable rainfall. The lowlands in the broken country have deeper and darker-coloured soils, which are constantly improved by washings from the higher levels. True black cotton soil occurs within the area of the Deccan trap in undulating or sloping situations, below the general level of the foot-hills. It varies in depth according to position and, where very deep, has been accumulated by alluvial deposit. In places in the valleys of the Tāpti, the Narbadā, the Godāvari, and the Kistna heavy black soil is often 20 feet in depth. Owing to its dense consistence it becomes unworkable during heavy rain, and, in these places, is better adapted for *rabi* crops of wheat, linseed, gram, &c., than for cultivation in the *kharīf* season. The black cotton soil of the Deccan trap area, which grows cotton and *jowār* as staple crops in the *kharīf* season, is, as a rule, only 3 or 4 feet deep, and is mixed with nodular pieces of limestone and small fragments of disintegrated trap. The subsoil contains a good deal of lime and, being shaly, allows free drainage to the trap rock below. Black soils vary in

The trap soils.

Black cotton soil.

colour, consistence, and fertility, but all are highly retentive of moisture. In the hot weather shrinkage due to evaporation causes the formation of numerous cracks, which are often several feet deep. This feature has given origin to the common saying, 'Black soil ploughs itself.' The deeper descriptions of black cotton soil are entirely unsuitable for irrigation; but the mixed black soil found in the smaller valleys, when it is of moderate depth and the substratum affords good natural drainage, admits of well-irrigation and produces under liberal cultivation all kinds of garden crops. The depth to the subsoil water in these situations is usually 25 to 30 feet.

Black cotton soil is also found in the valleys of streams and rivers outside the area of the Deccan trap. The chief Districts in which it predominates are Surat and Broach in Bombay, and Bellary, Kurnool, and Cuddapah in Madras. The soils here are alluvial in formation, and are practically identical with the deeper black cotton soils of the trap area.

Crops of the Deccan trap area.

The lighter descriptions of soil in the Deccan trap area grow *bājra* (*Pennisetum typhoideum*) and other millets; various pulses, including *arhar* (*Cajanus indicus*) and *khulāt* (*Dolichos biflorus*); also Niger seed (*Guizotia abyssinica*) and *pātsan* (*Hibiscus cannabinus*). With the exception of Niger seed, these crops are grown mixed. In the heavier black soils, cotton and *jowār* (*Andropogon Sorghum*) are the staple crops in the *kharīf* season, and a subordinate mixture of various pulses is grown with the *jowār*. The principal *rabi* crops are *rabi jowār*, linseed, wheat, gram (*Cicer arietinum*), and safflower (*Carthamus tinctorius*).

Pure black cotton soil is generally known as *regar*, and it is believed that the percentages of insoluble silicates, iron, and alumina which it contains are fairly constant within moderate limits. The amount of manganese is also very constant. Lime varies in amount, and also in the form in which it is found: it occurs usually both as carbonate and as silicate. Magnesia is always present in high proportion. The quantity of potash varies considerably, but is not usually defective. The amount of phosphoric acid, nitrogen, and organic matter is generally or frequently low.

Soils of the crystalline tract.

The gneiss schists, &c., of what is known as the crystalline tract occupy the whole of Peninsular India outside the areas of Deccan trap and alluvium already referred to. This tract comprises almost the whole of Madras; Mysore; the south-east portion of Bombay; the eastern half of Hyderābād and two-thirds of the Central Provinces; the Orissa and Chotā Nāgpur Divisions, and the Santāl Parganas and Bīrbhūm Districts of

Bengal; parts of the Mirzāpur, Jhānsi, and Hamīrpur Districts of the United Provinces; the Baghelkhand States of Central India; and a part of Eastern Rājputāna. There is also a long strip of similar formation along the east of Lower Burma.

The soils derived from the rocks of the crystalline tract vary so much that it is difficult to describe them even in a general way. In Mysore and Madras the soils are chiefly light-coloured, thin, and stony on the arid uplands, where they produce the poorest of crops; but the red or red-brown loams and clay loams of the lower levels are very fertile. Soils intermediate in character between these two extremes are found in great variety, and those which are of fair or good depth are irrigated with great advantage. Rice is the chief crop grown where canal irrigation is available; but tank and well irrigation is extensively practised, and a great variety of valuable crops are grown, especially under wells. The soils from this formation in Bombay, in the west of the Belgaum, Dhārwār, and North Kanara Districts, appear to be derived to a considerable extent from laterite, and are ordinarily clay-like in consistence and yellow-red or reddish-brown in colour. The poorest soils are those which are lightest coloured. The darker-coloured soils are very fertile, and in well-drained situations grow a great variety of crops. Rice is the chief crop on the lower-lying terraced and embanked fields. Throughout the whole of the red-soil area in Belgaum and Dhārwār, fruit-trees, especially mangoes, grow vigorously, as they do also in Mysore on somewhat similar soil.

The soils found on the crystalline tracts in other parts of India are generally lighter in colour than in Madras, Mysore, and Bombay, the red tinge being much less noticeable. In other respects there are the same differences in consistence, depth, and fertility, according to position. The crops grown vary with the rainfall and the facilities for irrigation. The best descriptions of soil are suited to a great variety of crops, and repay the cost of irrigation quite as well as the alluvial soils in the north of India. Like other Indian soils, those of the crystalline tract are deficient in phosphoric acid, nitrogen, and organic matter.

II. Cultivation

Indian tillage implements are generally few, simple in construction, and indigenous in pattern; for in a country of small holdings, poor cultivators, and very cheap labour there is little scope for labour-saving appliances. Those of some districts Tillage implements.

are more varied in kind and more effective than those of others, and the use of such patterns can in some cases be advantageously extended.

Ploughs. The plough is the principal implement, and is in many parts of India practically the only one used for preparatory tillage. There are many kinds, varying in weight and effectiveness, but the general pattern is the same for all. The part that penetrates the soil is a wedge-shaped block of hard wood. The draught-pole projects in front, and to it is attached the neck-yoke of the bullocks, while a short single upright stilt behind serves as a guiding handle. The point of the wedge (to which an iron share is usually attached) loosens the soil to a depth which varies with circumstances, while the body of the wedge moves the loosened soil but does not invert it. In moist soil the plough works like a single-tined grubber. If the plough is light the tillage is superficial, and the ground has to be gone over many times before the desired tilth is obtained. All Indian ploughs are not, however, light: there are many patterns, intermediate in weight and effectiveness, between the small plough which the Bengal cultivator carries afield on his shoulders, and the cumbrous Deccan implement to which four or six pairs of oxen are yoked. The latter is used in the fair season to break up black soil into huge clods, and penetrates usually 10 or 12 inches. Thousands of iron turn-furrow ploughs have replaced these heavy indigenous ploughs in the black soil plains of Madras, and some also are in use in Bombay and the Central Provinces; but where light ploughing is sufficient the cost of iron ploughs militates against their adoption. In the alluvium of Northern India a light plough with an iron soil-inverting mouldboard, drawn by draught-pole and neck-yoke, has been found useful. The hackneyed statement that an Indian plough merely scratches the surface is correct only as regards some tracts. Over the greater part of India a light plough is used for sowing seed. A bamboo seed-tube is attached to it, and the seed is dropped by hand through this tube as the plough works. The seed falls into the shallow furrow and is covered by the soil moved in making the next furrow. The seedlings do not come up in accurately straight rows, and some hindrance results to inter-culture, especially where the spacing of the crops would make it possible to use a bullock-hoe. The statistical returns for 1903–4 give the number of ploughs in British India outside Bengal as about 14,000,000. In Bengal complete figures are available only for four Districts.

Scarifiers.

The scarifier is unknown in Northern India, but is extensively used throughout the Deccan trap tract. The part which does effective work in loosening the surface soil and in eradicating weeds is an iron blade of varying length and shape. It is usually 3 feet or less in length and 2½ to 4 inches wide, with the cutting edge sharper than the other. The blade is fixed by two wooden or iron stays to a horizontal beam which forms the head-piece of the scarifier. To complete the implement a draught-pole and neck-yoke are required, with a stilt or handle to guide it. The scarifier is used extensively during the hot weather as a substitute for the plough, and also follows the plough to prepare the seed-bed. When at work the wooden head-piece passes over the surface and acts as a very effective clod-crusher, while the blade, working below the surface, loosens 2 or 3 inches of soil and raises weeds to the top. A heavy scarifier, drawn usually by four bullocks, is used with great advantage on black cotton soil in the hot weather. This soil cracks under the influence of a burning sun, and an inch or two of the surface also becomes friable. The scarifier loosens a little of the underlying hard layer, and, through its action, a good deal of the friable surface soil filters into the gaping cracks, so that every year a fresh layer is exposed for the reception of seed. A light scarifier is generally used after the seed-drill, to cover the seed and level the surface.

Seed-drills.

Seed-drills are used in the same tracts as the scarifier. They have a stout wooden head-piece which, like that of the scarifier, gives support and attachment to all other parts; and the pole, yoke, and guiding handle are secured in exactly the same way. Coulters are set obliquely at varying distances in the head-piece. A hole is drilled in each coulter, into which a bamboo tube is inserted. These tubes as they rise incline towards each other and meet about 3 feet from the ground to support the seed-bowl. Each tube communicates with a perforation in the seed-bowl, and bowl and seed-tubes are supported by ropes. The seed is fed by hand into the bowl. Two men are usually required for this implement, one to guide the bullocks, and the other to sow the seed. At work, the coulters cut furrows into which the seed drops before the soil falls back, the covering being completed by a light scarifier. In sowing mixed crops the seed is either mixed in proper proportion before sowing, or that of the subordinate crop is sown through a separate seed-tube, attached to the drill by means of a rope and guided along the track made by one of the coulters. In Gujarāt, many cultivators are extremely

skilful in sowing seed with a drill. Cotton, for instance, is sown in accurately straight equidistant rows. The seed-drills which are used for sowing *rabi* crops on black soil are heavier than those used for *kharif* crops, so that, in the absence of rain, the seed may be deposited in a moist layer and thus germinate properly.

Bullock-hoes. The use of a seed-drill economizes seed and saves much hand labour in weeding. Where the spaces between the drills are wide, it also permits the use of bullock-hoes, which are constructed in precisely the same manner as the scarifier but on a miniature pattern, the blades being from 7 to 15 inches in length according to the distance between the rows of crop for which they are intended. Bullock-hoes are worked in pairs drawn by one pair of bullocks, but each implement is guided by a man. The blade of each hoe cuts weeds and stirs the surface soil between the rows of growing crop, these beneficial operations being repeatedly and expeditiously performed at little cost.

Harrows. A three or four-coultered seed-drill, with the seed-bowl and seed-tubes removed, is sometimes worked like a light grubber or harrow; and a similarly constructed implement, with the tines closer together, is used as a harrow in the Madras and Bombay Presidencies. The hard wooden tines are a foot or less in length and are sometimes, but not always, tipped with iron.

Levellers and clod-crushers. Levellers and clod-crushers are used to smooth the surface before sowing, and also to conserve moisture. They consist in many cases of a rectangular beam of wood drawn by one or more pairs of bullocks; in Bihār the beam is sometimes hollowed so as to give two sharp edges. The plank is drawn by a pair of bullocks, and the driver stands upon it to increase its effective power.

Carts. The statistical returns for 1903–4 give the number of carts for British India outside Bengal as about 3,200,000. As in regard to ploughs, Bengal figures are available only for four Districts. Carts vary greatly in different Provinces in respect of size, construction, cost, and general utility. In some tracts they are very cumbrous; in others light and handy. The high-wheel carts common in Madras carry a fair load and are light in draft. A superior kind of cart is also used in the Bombay Deccan. The unwieldy carts of Upper India and northern Gujarāt require two pairs of bullocks when fully loaded.

Hand-tools for digging and earth-work. The hand-tools used in different Provinces for specific purposes vary considerably in pattern. In Madras heavy soils are dug with a crowbar. These soils, as has been said, crack

in the hot season, and the crowbar is inserted adroitly into the cracks and huge clods are levered out. In Bombay and Central India the Vaddars (professional diggers) use a strong blade of steel 15 to 18 inches long, and about 3 inches wide at the point. The blade is fitted, like a hoe, to a powerful hard-wood handle, 3 feet long. This implement is used with great effect on black soil when it has cracked. The tool used all over the country for purposes served in Europe by a spade or shovel has no appropriate English name. In Northern India it is called *kodāli*, in Southern India *māmūti*. It consists of an iron blade of varying width fitted to a wooden handle with which it makes an acute angle, and it is worked by the arms with the blade pointing towards the workman. Native picks vary in size and shape, and some of them are quaint in design. The original pick was made from the forked branch of a hard-wood tree, and picks of this character are still extensively used in forest tracts. The indigenous iron pick is of very much the same shape, while its size depends upon the use it is put to. A small pick is used for lifting potatoes, turmeric, onions, and crops of that class. Picks of English pattern have been so extensively introduced for railway construction and on relief works that they are coming into somewhat general use.

Sickles.

Sickles used for reaping grain crops or for grass-cutting are all of much the same pattern. Some are saw-edged. A worn-out sickle is cut down and shaped to make a serviceable weeding hoe (*khurpa*). Sieves of bamboo or grass, and riddles of various patterns, are used on the threshing-floor to handle the threshed chaff and grain, and to separate grain from chaff when the wind is not strong enough for winnowing in the usual way.

Winnowing sieves.

The winnowing scoop or *sūp* is used in every part of India. The corn trodden out under the feet of bullocks mixed with the broken chaff (*bhūsa*) is poured from a height, when the wind is strong enough to carry away chaff and light grains. The good grain is further cleaned of earth particles and other impurities by means of the *sūp*, which the women of every household can use very deftly. It is employed also to separate husk from ground grain or from pounded rice. Grain is ground into meal in the quantity required for daily use between two grinding stones.

Tillage and tilth.

The primary object of tillage is to prepare a favourable seed-bed. The methods adopted for this purpose in India vary, but are usually effective. The land is worked carefully by the plough in the interval between two crops whenever there is the right quantity of moisture, and the result is to produce a layer

of finely pulverized soil presenting the most suitable conditions for germination. In heavy soils the first tillage may consist of digging or deep ploughing during the fair season; this process produces large clods, which gradually weather and become friable as soon as rain falls, and it has the additional merit of keeping down weeds. The cultivator's art consists largely in judging the right time to plough, and in getting as much tillage done as is possible in the intervals of heavy rain, or during the short period between the cessation of the rains and the sowing time. Apart from the preparation of the seed-bed, tillage consists mainly in attention to the surface soil between the growing plants, and the maintenance of a layer of loose soil which reduces the loss of water by evaporation to a minimum.

Defective seed selection.

Dr. Voelcker (*Improvement of Indian Agriculture*, chapter xiii) found that the cultivator had much to learn in regard to the selection and change of seeds. This is largely due to economic conditions, which place the poorer peasants in a state of dependence on the money-lender (*baniā* or *mahājan*), who is generally also a grain-dealer. He takes over the greater portion of the produce of the land, either in payment of debt or as an ordinary purchaser, sells the best produce for consumption or export, and issues the unsold portion, which is necessarily inferior, for seed. A like deleterious effect is produced by the practice which prevails in some localities of ginning cotton at steam-power factories, where the seeds of various varieties are mixed and are handed back in this condition to the cultivators. The distribution of good seeds is one of the functions of the Government farms which will be referred to later on.

Irrigation specially necessary in India.

'Speaking broadly,' says Dr. Voelcker (*Improvement of Indian Agriculture*, chapter v), 'the normal state of an English soil is "wet" and that of most Indian soils "dry"; and whereas in the former the object is generally to get rid of the superfluous water by means of drainage, the difficulty in India is, as a rule, to keep the moisture in the land.' Hence the paramount importance of irrigation in a country throughout the greater part of which the rainfall is insufficient, precarious, or unevenly distributed. Irrigation forms the subject of a separate chapter (No. vi of this volume), where the reader will find a description of the great canal systems which have been constructed in India; of the humbler but no less important irrigation from wells, tanks, and *jhīls* (natural depressions); of the principal irrigation works in each Province; and of the scope for further extension of such improvements. Accordingly

we shall here deal only with the direct effects of irrigation on agriculture.

Without artificial irrigation large areas in India would lie permanently waste, or could be cultivated only in years of exceptionally favourable rainfall. Water-supply, land-level, and the character of soil are the three important factors which determine the possible extent of canal-irrigation. Broadly speaking, the facilities for this class of irrigation are extremely limited in the confused system of plateaux, hills, and valleys which make up the greater part of Peninsular India. The broken character of this portion of the country lends itself more favourably to irrigation in isolated patches of variable extent from tanks, wells, and smaller streams.

Facilities for irrigation in the three soil-divisions.

In the alluvial tracts of Northern India, on the other hand, which are traversed by mighty snow-fed streams, and in the deltas of the great Madras rivers, canal-irrigation is of primary importance. The comparative facilities for irrigation in the three great soil-divisions described on pages 8–11 show remarkable differences, which may be fairly gauged from the following tabulated statement taken from the Indian Irrigation Commission Report, 1901–3. The figures given are for areas for which there were fairly reliable returns, including Native States :—

	Area annually cropped, in millions of acres.	Percentage of Cropped Area irrigated from				
		Canals.	Tanks.	Wells.	Other sources.	Total.
Alluvial tract .	135	12.4	1.8	7.3	3.6	25.1
Crystalline tract .	100	1.5	7.3	4.2	2.5	15.5
Deccan trap .	58	0.2	0.3	2.4	0.3	3.2
Total	293	6.3	3.3	5.3	2.6	17.5

Canal and well irrigation in the alluvial tract.

The alluvial tract is specially favoured by its facilities for canals and wells. It is also favoured in other ways, for the cost of applying the water and of growing an irrigated crop is much less than in Peninsular India generally. The irrigation is largely by flow, and where it is necessary to raise water from one distributing channel to another the cost is comparatively trivial, as the 'lift' is generally small. A preliminary watering to facilitate tillage is required in some localities, and is usual when the rains have ceased early; in this case tillage is necessarily hurried in order to sow before the land again becomes

too dry. After sowing, the fields are divided by low ridges into compartments (*kiāri*) of varying size. Distributing water channels are formed between each double line of *kiāris*, and each *kiāri* is irrigated in turn and gets as much water as the cultivator thinks desirable. A wheat crop sown in October or November, and occupying the land for four and a half or five months, requires only three or four waterings to bring it to maturity, because the clay loam of the alluvial tract readily retains moisture in the cold season; the air is cold and moist, and evaporation from the soil is thereby minimized; dew is deposited in considerable quantity, and there is usually a fair winter rainfall. In the north of India these circumstances combine to make the effect of irrigation somewhat analogous to that of sufficient and well-distributed rainfall. The light dressings of manure which would ordinarily be applied to 'dry' crop lands are, with the aid of water, sufficient to produce excellent crops. Irrigation is cheap, and the other contingent expenses are quite within the means of any ordinary cultivator.

Large areas in the alluvial tract depend on well-irrigation, which is thus of the greatest importance. During recent years, partly owing to the grant of advances for the construction of wells, there has been a large increase in the area irrigated in this manner. Masonry wells are the most permanent form of supply, but in many localities unbricked wells are made at a small cost, and last a season or several years according to the nature of the soil. With the help of well-irrigation, the Jāt, Kurmī, Kāchhī, and Koerī farmers of Northern India produce excellent results.

Tank-irrigation in the crystalline tract.

These conditions are in marked contrast with the more difficult and costly irrigation which is, as a rule, necessary in Peninsular India. In the crystalline tract, irrigation from tanks is the most extensive, but that from wells is also important. Tanks which can be relied upon for remunerative irrigation in average seasons require considerable catchment areas, which usually extend over poor upland waste lands. The bed of a tank may, and usually does, occupy cultivable land, and the chief crop grown under it is rice. On sloping ground terracing is necessary, and has in many places been carried out with great ingenuity. The construction of a tank and terracing entail considerable cost. The terraces are divided into compartments or *kiāris* by means of permanent earth embankments which vary, according to situation and other circumstances, from 1 to 2 feet in height. Where the original surface is uneven, the *kiāris* are necessarily smaller

and more irregular in shape than in the more open level tracts. In a group of terraced rice-beds, a main channel, fed from the tank, is made to distribute its water equally over all, the embankments being so arranged that a slow stream passes over the beds in succession, from the higher to the lower levels. The embankments serve also to impound rain, thus economizing the artificial supply.

In Madras and Mysore an excellent system of chain tanks is common. These tanks are constructed in favourable positions throughout the length of a valley, each having a catchment area of its own, but also obtaining water from the area irrigated by the tank immediately above. Supplemental wells, sunk in the lands irrigated by the tank, supply water after the tanks run dry, thus enabling the ryots to save their crops in times of deficient supply, and in favourable seasons to grow second crops with assured success.

Irrigation in the Deccan trap tract chiefly from wells.

In the Deccan trap tract the areas irrigated from canals and tanks are small, but a considerable area is cultivated under wells. The extension of irrigation is here strictly limited by the broken character of the country, by the general poorness of soil in some places, and by its unsuitability in others. It is generally believed by practical agriculturists that the fertility of deep black cotton soil is temporarily if not permanently lowered by irrigation. On the other hand, where black soil is moderate in depth, and is naturally drained by a porous sub-layer, it is particularly suitable for well-irrigation.

High farming under well-irrigation.

The land of this class in Peninsular India which is irrigated from wells, or by lift from other sources of supply, represents some of the highest farming in the country. The soil is heavily manured and liberally cultivated. In order to economize water, elaborate arrangements are made for distributing it. Each field is marked with exactness, so that beds of any required size may be formed. The beds are commonly 10 feet square, or even smaller, and are worked with a hoe after preparatory tillage has been completed. In these beds the crop is sown or planted, the water being admitted to each in turn from a water channel between double lines of beds. On soils which are ordinarily absorptive, irrigation is required every ten or twelve days in the cold weather and every seven or eight days in the hot season. A well capable of irrigating about 4 acres of land may cost from Rs. 250 to Rs. 1,000, according to the depth of subsoil water, the difficulty of excavation, and the permanency of construction. In places the subsoil water is brackish and therefore suitable only for particular

crops. For a perennial crop like sugar-cane, the cost of lifting water from a well by the ordinary indigenous lifts may exceed Rs. 100 per acre. Water is almost invariably raised from wells by manual labour or by means of bullocks, and the lifting appliances in common use are described in chapter vi (Irrigation).

Manures.

The chief obstacle to the improvement of Indian agriculture is the need of manure. Water and manure together, says Dr. Voelcker (*op. cit.* chap. vii), represent in brief the ryot's main wants. The chief supplies are derived from the dung of farm animals, the litter of cattle sheds, and household waste. The urine of farm animals, which weight for weight is as valuable a fertilizer as dung, is in most parts of the country entirely wasted, while the dung is largely burnt as fuel. In the larger villages and in the towns there is special waste. The cattle used for traffic, the milch cattle, horses, &c., are all fed on concentrated food produced by agriculture, yet little of their manure goes back to the land. We may deplore the loss by burning, but it is inevitable where wood is not available. The consumption of dung as fuel lends special importance to the policy adopted by Government of reserving and controlling areas where a supply of firewood may be looked for in the future, and in the forests under state control timber and minor produce are granted free, or at reduced rates, to the people resident in the vicinity.[1]

Town waste as manure.

The manure which could be obtained from towns would, if fully utilized, help Indian agriculture very materially. Sanitation is improving, and town sweepings and night-soil are now used as manure to a larger extent than was formerly the case. In some places a considerable impetus has been given to the cultivation of irrigated crops by the manufacture and use of poudrette, or the contents of trenches in which night-soil has been mixed with earth. Town drainage has necessarily followed the introduction of improved water-supplies, and near Amritsar and other towns in the Punjab the sullage is run on to the deep absorptive alluvial soil. Karāchi, Ahmadābād, and Madras have their sewage farms, the sewage being applied to sandy soils. Enormous crops are thus produced in rapid succession without injury to the public health. In the vicinity of many Indian towns the soils are, however, not suitable for the direct application of crude sewage. The poudrette system of disposing of night-soil is, from an agricultural point of view, eminently satisfactory. It is in no way antagonistic to native usages and,

[1] See chap. ii, Forests.

if properly carried out, produces a manure which can be carried some distance by cart.

Of recent years various schemes for the drainage and sanitary improvement of towns and for the establishment of sewage farms have been put forward. It has, moreover, been experimentally demonstrated that town sewage, if purified in septic tanks and filter-beds, gives an effluent which produces an enormous out-turn of valuable garden crops, and can be used as continuously as canal water on land suitable for irrigation. A small installation has for some years irrigated and manured a few acres of land in a suburb of Bombay, with excellent sanitary and agricultural results. At Poona also the Bombay Agricultural department carries on experiments in the purification and utilization of sewage, and enormous crops have been produced on the land dealt with (thirteen acres).

Improved conservation of manure necessary.

The improvement of sanitation in towns will benefit agriculture, but at present the better conservation of manure in the villages is agriculturally far more important. In practically every part of India the outlying fields of villages are rarely manured. The natural fertility of deep black cotton soil, and of the deep alluvial soils of the north of India, which are sometimes renewed by silt deposits from rivers and canals, is undoubtedly great; but sooner or later the loss caused by the removal of crops must be returned as manure or else the producing powers of these soils will be affected. A great deal of land, particularly in the poorer tracts of Peninsular India, is slowly undergoing exhaustion for lack of manuring, and the ultimate return of all organic matter to the land is the ideal to be kept in view. In some parts of India social customs facilitate improved methods. Wells are numerous where the soil is good, and the intensive cultivation necessitates adequate supplies of manure. The peasants are not crowded in villages, but occupy little hamlets amid their fields. Sanitation is thus improved, and the manurial value of household waste is distributed farther than in the ordinary village community. The cultivator is on the spot to watch his crops, and during a large part of the year he tethers his cattle in his fields at night. The droppings are applied evenly to the land as the feeding place is moved daily. Sheep and goats are, in some localities, systematically penned at night to manure the fields for particular crops.

Use of leaves, &c.

In parts of Madras and Mysore particular trees are grown by ryots on the dams of tanks and on waste land, to provide leaves and tender twigs for use as green manure. Rice under tanks is

extensively manured in this way. In various parts of India wild indigo, and other plants which grow freely on waste lands and are not grazed by cattle, are similarly employed. Speaking generally, the cultivator is quick to seize any chance of supplementing his limited stock of manure.

Mineral manures.

The resources of India in mineral manures are relatively small, and it is doubtful whether it will ever pay to import chemical manures for ordinary crops. Planters import them, however, for tea, coffee, and sugar-cane. Mineral phosphates of generally poor quality have been discovered in various parts of the country, and in large quantity in some places; but for general use it is believed that Christmas Island phosphates, which are very pure and can be imported at low rates, would be cheaper. Crude nitre (saltpetre) is a local product in the north of India and in Madras. It is largely obtainable from ancient village sites at about 60 per cent. purity. Nitre of this quality is cheap, and is used locally as manure, particularly for rice, wheat, and tobacco. The price of refined nitre has hitherto prevented its use by the ordinary Indian cultivator, and it is mainly exported, principally to the United Kingdom. Gypsum is obtained extensively in the Salt Range, and locally in other places. It may prove useful for some crops, especially in the treatment of soils containing an excessive amount of soda, if it can be brought to such land at a reasonable price.

Use of bones as manure.

Bones are in most countries regarded as valuable manure for almost all cultivated crops; but almost everywhere in India the value of bones for manure is disregarded by the cultivator. This is due partly to religious and caste prejudices, partly to the difficulty of crushing and heating them, and partly to their small effect on some Indian soils. They are, however, employed with useful effect by tea and coffee planters. Experiments have proved that for irrigated or 'dry' crops bones, though crushed fine, are, if otherwise untreated, extremely slow in their action. Dissolved bones are more effective, but the cost is prohibitive, as sulphuric acid is not yet made in India. The export of bones during late years has averaged about 100,000 tons per annum; and the export trade has raised prices to so high a pitch that oil-cakes and other by-products, which are more effective as manure, can be obtained almost anywhere in India at much cheaper rates.

Oil-cakes and fish-manure.

In irrigated garden lands, castor-cake and *karanj* cake (made from the seeds of *Pongamia glabra*) are extensively used as manure and, owing to an increased demand, have risen largely in price. These cakes are now dearer than certain edible

cakes which are much richer in the more important elements of fertility, namely, nitrogen, phosphoric acid, and potash. It has been experimentally proved that safflower, Niger seed, ground-nut cake, cotton-seed cake, and cotton-seed are, in equivalent applications, more effective and economical manures for sugar-cane than the ordinary manure cakes. It is of course poor economy to use edible cakes as manure, but it is still less profitable to give them as food to cattle if the dung is burnt as fuel. Fish-manure is used along the west coast in various places, but cannot be carried far inland as, being badly preserved, it decomposes rapidly.

Green manuring. Green manuring is a common practice in respect to irrigated crops. Several crops are grown for this purpose, the most common being horse gram (*Dolichos biflorus*) and Bombay hemp (*Crotalaria juncea*), commonly called *san*, both Leguminosae. The *san*, which grows rapidly, quickly shades the ground and smothers weeds: it is ploughed in when 3 or 4 feet high. The system of green manuring is cheap, effective for some crops, and well within the means of all except the poorest cultivators.

Improvement of manure supplies. It has already been indicated that there are avoidable losses of manurial matter in India; but the husbandman is becoming more alive to the utilization of available supplies. The establishment of fuel and fodder reserves, and the extension of irrigation and other works calculated to avert famine, will help the cultivator to store a larger quantity of farm-yard manure than he does at present, and will make him less dependent upon outside supplies.

Fallows. In no part of India is bare fallowing practised, except, in fairly large holdings, on the deep black cotton soil of the Broach District of Bombay. The fields are there rested for a year and are very carefully tilled during this time. Under the standard rotation of *rabi* and *kharīf* alternately in Northern India, the *rabi* is followed by nearly three months' rest, and the *kharīf* by an interval of nine or ten months. On the whole, it may be said that the land gets as much rest as the cultivator can afford to give.

Cultivable land left waste. Throughout Peninsular India, in the more open tracts where the agricultural population is sparse or not congested, land which has become reduced in condition by cropping is allowed to lie waste, usually for several years, to recover fertility. This practice is due to various reasons, the chief being want of capital, labour, cattle, and manure. The land when waste is soon overgrown, and much work is required to make it fit for crop-growing.

It is extremely doubtful if this sort of fallowing is actually remunerative, although increased fertility is thereby acquired.

Intermittent cultivation in virgin soils.

Within the forests, and in areas which have recently been opened up for cultivation, the patches that grow crops are changed from year to year. This practice is at the present day most prevalent in Burma, Assam, the Central Provinces and Central India, and on the Western Ghāts. The crops raised and the extent of fallowing vary with local conditions of soil and climate. The following description of what is done on the *varkas* lands of the Western Ghāts gives a general idea of the prevailing practice. A short rotation of crops, chiefly inferior millets, is followed by a period of rest varying from three to ten years, during which time the land lies waste. After fallow the land is prepared by cutting the scrub growth in the hot weather. This is laid evenly over the surface, and is generally supplemented by branch wood obtained in the forest and by dried grass and straw which has little or no value as fodder. The material thus arranged is burnt slowly from the lee side. *Nāgli* seed (*Eleusine coracana*) is then sown broadcast in the ashes and lightly ploughed in at the first fall of rain. The surface is subsequently broken and levelled by hand implements, but is usually left very rough. If ploughing is impracticable, as it often is on steep land, the seed is covered by digging with a hard-wood pick. The thinning out of superfluous seedlings and a little weeding are the only other operations till harvest time. The preparatory tillage for the other crops of the rotation—generally *vari* (*Panicum miliaceum*), *harik* (*Paspalum scrobiculatum*), and Niger seed (*Guizotia abyssinica*)—is somewhat more careful; but the system is haphazard to a degree, and is manifestly a modification of the nomadic cultivation which at one time was more extensively practised than at present.

Nomadic cultivation.

The aboriginal hill tribes live mainly on wild tubers and other forest products which they know precisely where to find. These natural foods are supplemented by cultivation of the most primitive kind, rice, maize, millets, oilseeds, and cotton being the principal crops grown. The tribes are diverse in their habits and origin, but nomadic cultivation is practised by all. It consists of burning down a patch of forest in a situation favourable as regards soil and rainfall for cultivation, and sowing seed, after little or no preparatory tillage, in the ashes and cleared soil. In some cases a crop is taken from the same clearing for two or three years in succession, but a new patch may be selected annually. Nomadic cultivation has been a formidable enemy to forest conservancy, originating fires which

cause much destruction. At the present day the system is more under control, and destructive fires are due either to accident or set purpose. In the latter case the object is to burn old grass and scrub growth, and thus improve the natural grazing. Settled cultivators owning cattle are now more responsible for such forest fires than the wandering aboriginal tribes. Nomadic cultivation is known as *taungya* in Burma, *jhūm* on the north-eastern frontier, *dahya* in Central India, *khīl* in the Himālayas, and *kumri* in the Western Ghāts.

Rotation of crops.

The practice of regular rotation of crops is followed in many parts of India. The ryot knows that the fertility of his field cannot be maintained at a high standard if the same crop is taken too often in consecutive years; and he knows, too, which crops are particularly exhausting and which exercise an ameliorating influence on the soil. The staple crops are regulated by local conditions of soil and climate, and the rotations that are possible are similarly determined as the result of experience. Local conditions are so variable, and the cultivated crops so numerous, that it would be difficult to specify typical rotations representing wide areas. The common Indian system of growing mixed crops serves in many respects the purposes of rotation. It is undoubtedly a successful and profitable method, which has done more to uphold the fertility of Indian soils than any other practice. There are very good reasons why it is profitable to grow pulses, oilseeds, and fibre plants mixed with, or subordinate to, cereals like *jowār*, *bājra*, or wheat. Owing to the variability of the seasons the Indian cultivator is at sowing time most uncertain as to harvest prospects, and experience proves that the risk of total failure in an unfavourable year is minimized by growing a mixed crop. If the pulse fails the cereal may succeed, and vice versa. Pulse crops, whether grown alone or in combination with other crops, exercise another beneficial influence in that they enrich the soil with nitrogen, of which element Indian soils require a frequently renewed supply. The common growth of these pulses is a testimony to the fundamental soundness of the traditional agricultural practice of the country. No pulse crop cultivated in India exercises such a general fertilizing effect as *arhar* (*Cajanus indicus*). It is grown in every Province mixed with other crops; its long tap-root enables it to withstand drought and to search in the subsoil for plant food; it spreads out and grows freely after the cereal, to which it is subordinate, has been harvested; and nearly all the leaves fall as the plants ripen, thus enriching the surface soil.

Mixed crops.

III. Principal Crops

The more important field and garden crops cultivated in India are set forth in detail in Table II at the end of this chapter (pp. 98–9), while Table III (p. 100) gives for each Province the area under rice, wheat, millet, pulses, sugar-cane, fodder crops, tea, opium, tobacco, indigo, and cotton, in the year 1903–4.

The cultivation and general characters of the most representative crops will now be described.

Rice. Rice (*Oryza sativa*) has been cultivated in India from the very earliest times, and is the staple food of a great portion of the people. It is essentially a crop of damp tropical or semi-tropical climates. The finest varieties and the largest yields are produced in tracts which, during the growing season, afford a moderate degree of sunshine and a damp warm atmosphere. Rice is therefore the staple crop in all areas of heavy and assured rainfall; but good crops are produced in districts which receive moderate or even light rain, when this can be assisted by sufficient irrigation.

Area cultivated. The normal rice cultivation in India exceeds 109,000 square miles, of which more than half is in Bengal. Rice production has, in recent years, extended more rapidly in Burma and Assam than elsewhere. These Provinces now cultivate respectively about 13,000 and 5,000 square miles. The areas for the other important rice-growing Provinces are (in square miles)—United Provinces 11,000, Madras 10,000, Central Provinces 7,000, and Bombay 4,000.

Varieties. The varieties of paddy, as unhusked rice is often called, are exceedingly numerous, and the peasants know the conditions of soil, cultivation, climate, and water-supply most suitable for each of the several local kinds. These vary from very fine to very coarse, with numerous intermediate varieties. Most of the finest grades are grown from transplanted seedlings, and have long, thin, sharp-pointed grains, which are yellow or golden yellow in colour. The husked rice is nearly white, very translucent, long, and thin. The finest rice is also fragrant or scented. The grains of coarse varieties are usually large, full-bodied, deeply scored, and dark coloured, while the husked rice is usually thick and opaque. Its colour may be white, creamy white, pale brown, or reddish brown.

There are also early, medium, and late-ripening varieties of paddy. The last are generally the finest and need a full supply, but a small depth, of water throughout the growing

season. Some coarse long-stemmed varieties thrive on land which is liable to be flooded, and others are adapted for salt deltaic land reclaimed from the sea. The head of grain varies from a large drooping panicle to an erect small one.

In parts of Madras, on canal-irrigated lands which are fertilized by silt, three crops of rice are often raised in a year. In most other parts of India rice-beds yield only one crop of rice annually, but another crop (usually a pulse) is taken when conditions are favourable. Outside Madras rice is generally a *kharīf* crop, sown as early as possible after the south-west monsoon sets in. In Bengal, however, there are two main harvests, the *āus* or early crop being sown on comparatively high lands during the spring showers, while the *āman* crop is sown in the lower fields in June and July. Season of growth.

Rice is everywhere grown in embanked fields. Level or nearly level beds are necessary, because rain or irrigation water must be impounded and kept at a height which should vary as the crop grows. At no time should more than two-thirds of the plant be immersed where fine short-stemmed varieties are grown. Rice-fields and their preparation.

The best soils for rice are clays or clay loams of fair depth. The crop luxuriates on soil through which water can percolate with freedom, and over which it flows slowly; but in Northern India it is grown successfully even on clays which are almost impervious.

Many rice-fields which receive much silt with irrigation water are rarely or sparingly manured. Otherwise a good crop is exhausting, and liberal manuring is generally necessary to produce a valuable variety. In places green manuring is practised, for which purpose *san* (*Crotalaria juncea*) is sown thickly with the first fall of rain. In Madras and the coast districts of Bombay, the green leaves and twigs of certain trees are used as manure. Castor-cake is sparingly used in places; but by far the commonest applications are ordinary cattle dung, and tank mud where available.

Rice is sown in three ways—broadcast, by drill, and by transplantation from a seed-bed where it has been sown broadcast. As a rule the first method is practised on inferior soils, or where labour is scarce. Rice is drilled in some districts of Bombay, but this system is not common. The third method is much more usual than the others, and is less risky. Broadcast or drilled rice requires 80 to 120 lb. of seed per acre, while the seed rate of the transplanted crop varies from 30 to 80 lb. per acre. Methods of sowing.

Rice transplanted from seed-beds.

The seed-beds are highly manured, sheep or goat droppings being a favourite application. The tillage should be careful, and is often accomplished by hand implements. The seed is sown very thickly in fine tilth with the first fall of rain. In the heavy rainfall tracts of Bombay the seed-beds are subjected to a process called *rab*. Cow-dung, brushwood, dry leaves, and coarse grass are spread in a thick layer over the surface and then burnt, the seed being sown in the fine earth and ashes. No other manure is applied. The seedlings come up strong, with few or no weeds. A seed-bed should supply seedlings sufficient to transplant from six to ten times its own area.

If the seedlings grow unchecked in the seed-bed they are ready for transplanting in four to five weeks, when they are 8 to 10 inches high. The cultivation of the general area begins when the soil is well soaked, and should be complete by the time the seedlings are ready. Each rice-bed (*kiāri*) should be twice ploughed when well soaked with the first fall of rain; and afterwards, when the seedlings are nearly ready for transplanting, it should be puddled into a thin mud by further ploughing and trampling of the cattle.

In removing the seedlings from the nursery care must be taken not to damage them, and the seed-beds are flooded so that they may be easily uprooted. The roots are washed in the water, and the seedlings are tied into bundles and carried to the field, where they are planted by hand, the root ends being forced into the soft mud. About four seedlings are planted together, at intervals of 6 or 8 inches, the regularity and deftness with which the work is done being astonishing. In a week the seedlings get rooted and regain a healthy green colour. Weeding is necessary, but little is required when there is sufficiency of water. If the field has not already dried up, the water should be drawn off about ten days before the crop is ripe.

Broadcast and drilled rice.

Broadcast and drilled rice receives in Peninsular India a considerable amount of weeding. Superfluous seedlings are removed in places, and vacancies filled up. A curious system of cultivating rice prevails in parts of the Central Provinces. The seed is sown thickly broadcast in the *kiāris*, and a plough is worked among the seedlings when about 10 inches high, with the result that many are uprooted and the weeds disturbed. The latter are then removed and the rice seedlings take root again in the mud. This system, known as *biāsi*, has some of the advantages of transplantation.

The field should be comparatively dry when the rice crop is

harvested; but in Bengal this is sometimes impossible, and the reaped crop has then to be carried laboriously in head-loads to be dried in the sun on higher ground. Early varieties of the *kharif* crop ripen in September and October, and the late varieties in November and December. The crop is cut with a sickle near the ground and laid in open bundles of sheaf size. These get dry in a few days, and are then tied into larger bundles and carried to the threshing-floor. The grain is threshed by beating on a board or log of wood, placed over a large cloth so spread out as to catch the grain as it falls. A small bundle is beaten at a time and a few vigorous strokes separate most of the grain. The crop is also trampled under the feet of oxen, and in this way all the grain can be separated. The straw when threshed on a board as described makes excellent thatch, but poor fodder. Harvesting and threshing.

The yield in different tracts, from different soils, and from different methods of cultivation varies very greatly. In good soil an average transplanted crop yields about 2,400 lb. of paddy per acre in a favourable season. Broadcast and drilled rice yield much less. Out-turn.

There is a large export of rice from India in normal years. During the ten years ending with 1899–1900 the exports averaged 31,500,000 cwt., valued at nearly 13 crores. In 1903–4 they were 44,000,000 cwt., valued at 19 crores. The bulk of the exported rice comes from Burma. This Province, though its production is far less than that of Bengal, grows rice principally for export, while the harvests of the other rice-growing tracts are mainly for home needs. When India suffers from bad seasons, much of the Burma rice is diverted from foreign to Indian consumption.

The varieties of wheat most commonly cultivated may be referred to *Triticum vulgare*; but two other forms are extensively grown in India—*T. Spelta*, spelt wheat, and *T. pilosum*, velvet-chaffed wheat. Wheat.

This cereal, which has been cultivated from prehistoric times in Europe, Asia, and Africa, is essentially a crop of the warmer and drier parts of the temperate zone; but its limits of growth are wide, its varieties being adapted to nearly all climates. Wheat can be raised successfully with a greater range of temperature than perhaps any other cultivated plant. In India it is always grown in the cold weather, most extensively in the north, and hardly at all in the south. The young seedlings of the hardier varieties are not killed by frost, but cold causes damage as the crop is approaching maturity.

Area cultivated.

India grows more than 31,000 square miles of wheat. The 'dry' crop areas vary considerably from season to season, depending upon the character of the late rainfall. To some extent the crop is interchangeable with other *rabi* crops, such as linseed and gram, which require less moisture. In 1903-4 the areas in the important wheat-growing Provinces were (in square miles)—Punjab and Frontier Province 13,600, United Provinces 12,200, Central Provinces and Berār 5,300, Bombay (including Native States) 3,400, and Bengal 2,300.

Varieties.

Wheat of nearly all varieties is 'square head' in appearance and fully awned. The grain may be classed into hard and soft white, hard and soft yellow, and hard and soft red. There are very few soft white varieties. Muzaffarnagar wheat, which is of this class, is in great demand for export, the hard white *bakshi* of the Central Provinces and Bombay being next in favour. The grains of the best varieties are long, elliptical, fairly well filled, and heavy.

'Dry' crop wheat.

In Bombay, the Central Provinces and Berār, and Central India 'dry' crop wheat is extensively grown on deep moisture-holding black soil, and excellent crops are produced if the late rains are favourable.

The chief crops rotated with 'dry' crop wheat are linseed, gram, safflower, and *rabi jowār*; and a subordinate mixture of linseed, gram, or safflower is often grown with the wheat.

The preparatory tillage is usually careful. It begins with the scarifier before the monsoon, and this implement is also worked once a month during the rains when the soil is in suitable condition. Black soil is not often manured for 'dry' crop wheat. A light dressing may be given, if available, in August and ploughed lightly in. The seed is sown in October, by a heavy two or three-coultered drill, or a seed-tube attached to a plough, 60 to 100 lb. per acre being required. Very little weeding is needed. Little rain falls after sowing, and the crop ripens in three and a half to four months. A good average crop yields about 800 lb. per acre.

Irrigated wheat.

Irrigated wheat is most important in the north of India, where it is very successfully raised by canal and well irrigation on the deep alluvial loams. It is grown alone or mixed with gram or barley, or there may be subordinate rows of rape and a sprinkling of mustard. On the virgin soils of the new canal colonies wheat is a favourite crop, as it is in keen demand for export.

Careful tillage is necessary to secure a good crop of irrigated wheat. Usually the land sown has borne no crop in the *kharīf*

season, and between August and October it is prepared with a light plough which is used repeatedly. Manure in light dressings is applied in September, and is mixed with the soil by the subsequent tillage. Sowing begins in the middle of October, and the seed, which is applied at the rate of about 100 lb. per acre, is sown through a seed-tube attached to the plough or dropped by hand in the furrow. The surface is then smoothed with a clod-crusher and roughly formed into beds for irrigation. A preliminary flooding may be required for tillage when the rainfall is light or when the rains have ceased early. In this case ploughing does not begin until October, and the whole of the preparatory tillage is done in two or three weeks. The crop takes about five months to come to maturity, and requires three or four waterings, unless the winter rains are specially favourable.

Wheat is reaped with a sickle, or is uprooted by hand aided by a blunt sickle. The surface soil at harvest time is dry and loose, and the plants are easily taken up. The crop is usually very dry when harvested; and it can therefore be threshed almost at once. The straw and grain are trampled out under the feet of bullocks, and the grain is easily winnowed in the hot winds which blow in April. The chaff (*bhūsa*) provides a fairly good fodder which, however, is much improved if mixed with chaff similarly obtained from gram and other pulse crops which enter into the rotation of wheat lands.

Irrigated wheat on land liberally manured yields from 1,200 to 1,600 lb. of grain per acre. The out-turn may, however, be seriously diminished by rust, which is most prevalent with cloudy weather in February. It damages the crop less often in the north than in Bengal, Central India, and Bombay. Out-turn.

The exports of wheat fluctuate with good and bad seasons, the wheat produce of Northern India being largely retained in the country when there is scarcity or threatened scarcity in the famine zones. Thus, while during the ten years ending with 1899–1900 the exports averaged 12,500,000 cwt., in 1900–1, after a serious famine, they were only 500,000 cwt. In 1903–4, on the other hand, they rose to 26,000,000 cwt., valued at 11 crores. In 1903, out of about 60,000,000 cwt. of wheat imported into the United Kingdom, 17,000,000 cwt. were from India, the only countries which sent larger amounts being the United States (24,000,000 cwt.) and Russia (a little over 17,000,000 cwt.). Indian wheat imported into England has the reputation of being 'dirty'; but Dr. Voelcker has shown[1] that Exports.

[1] *Report on the Improvement of Indian Agriculture*, chap. xiv.

this is in no way due to bad cultivation or careless threshing on the part of the ryot, but to deliberate adulteration to suit the requirements of the English corn trade.

Millets.

Indian millets are of two types—*jowār* and *bājra*, which have large leaves and stout stalks and grow to a height of 6 to 8 feet or more; and the small millets which grow to a height of only 3 feet or less. *Jowār* and *bājra* are much more important crops than the smaller millets. They occupy together about 20,000 square miles in Bombay, 11,000 in Madras, 8,000 in the Central Provinces and Berār, and 9,000 to 11,000 in the United Provinces and the Punjab. *Jowār* will probably, in time, also become an important crop in the dry zone of Burma.

Jowār.

Jowār (*Andropogon Sorghum* or *Sorghum vulgare*) is commonly known as grey millet, and in Madras is styled *cholam*. It is doubtful whether it was originally a native of India. The Guinea corn of the West Indies, the Dhurra of Egypt, the Kaffir corn of South Africa, and the Broom corn of Italy and the United States are all millets somewhat similar to *jowār*.

The number of varieties of *jowār*, the cultivation of which will be described here as representative of the millet crops generally, is very large. Some grow best in the rains, others in the *rabi* season, the former being much the more numerous. There are early, medium, and late-ripening kinds. The length and stoutness of the stalks and the size of the grain-head depend greatly upon the season, the kind and condition of soil, and the cultivation. A healthy plant produces only one shoot, and generally each stalk produces only a single head of grain. The heads of grain vary much in size, weight, and colour. The weight may range from 2 oz. or less to 1 lb. or more, while the shape assumes many forms varying through infinite gradations between a hard densely packed conical head and a much-branched drooping panicle. The colour ranges, according to variety, from pure white, through all the shades of yellow, amber, and red, to a dull brown. The best grain is pure, or creamy, white.

Jowār as a fodder crop.

In addition to its food-services, *jowār* is the most important fodder crop over a large part of India, and the fodder of all varieties is much improved if the seed is sown thickly. The crowded plants grow tall and thin, and the stalks are much less woody than those of a crop grown specially for seed. The best fodder variety is the *sundhia jowār* of Gujarāt. A good crop of this variety is very dense, and stands 9 to 11 feet high, with stalks not much thicker than strong wheat straw, which

can be given to cattle with no waste. The best fodder varieties, when liberally cultivated, yield enormous out-turns. In favourable seasons, or with irrigation, more than 30,000 lb. of green fodder per acre can be obtained, which when dry will weigh about 5 tons.

Kharīf and rabi jowār.

Jowār is the staple grain crop where pure or mixed black soils predominate, and is very successfully grown in rotation with cotton. The rainfall most suitable for *kharīf jowār* is from 30 to 40 inches per annum. In the Deccan, *jowār* occupies the lower-lying, deeper, and more fertile soils, as well as the more open black soil plains, and gives place to *bājra* (known in Madras as *cambu*) on the shallow mixed black and red and the lighter-coloured stony soils found on sloping ground. *Jowār* also does very well in the alluvial tract, particularly on the clay or clay-loam soils, while *bājra* is sown on more sandy soil.

Rabi jowār is grown extensively in black soil areas affected by the retreating south-west monsoon. Elsewhere its successful cultivation depends upon two conditions—a soil that is dense and deep enough to retain moisture, and the sufficiency of the late rainfall, the September and October rain being particularly important.

The *kharīf* crop.

On black soil a good deal of the preparatory tillage for the *kharīf* crop, which is done with the scarifier, should begin in the hot weather. This implement should also be worked two or three times after the first rains. The crop requires a fine friable seed-bed, and the land should be ready for sowing by the end of June. *Jowār* is not usually manured: any manure available is given to the rotation crop, cotton. Various pulses, oilseeds, and fibre plants are grown with *kharīf jowār*. The most common mixtures are *arhar*, *mūng*, and *urd* (pulses), *til* (an oilseed), and *ambādi* or *pātsan* (a fibre plant). The ordinary seed rate per acre is 6 to 8 lb. of *jowār* and $1\frac{1}{2}$ to $2\frac{1}{2}$ lb. of the subordinate pulse mixture. The seeds are generally mixed before sowing, and are sown with a three or four-coultered seed-drill in rows 14 to 16 inches apart. *Jowār* seedlings are very small and delicate when they first come up, and timely hand-weeding is therefore necessary. The seedlings soon get strong, and when they are 4 to 6 inches high bullock-hoeing is required, which should be repeated at least three times when the surface soil is dry and workable. Superfluous seedlings are thinned out, the strongest being left about 9 inches apart in the rows. The *jowār* ripens in October and November: the small pulses are reaped earlier, but *arhar* and *ambādi*

are left standing in the field after the *jowār* has been reaped. Birds are very destructive to *jowār* and some of the other millets, and the crop requires to be watched for a month or six weeks before harvest.

The method of harvesting depends upon the character of the crop. If the stalks are coarse and tall they are cut with a sharp sickle, and a long stubble is left which is subsequently uprooted and gathered for fuel. If the crop is thick and the stalks fine, the plants are partly reaped and partly uprooted with a blunt sickle. After a few days' exposure in the sun the heads of grain are cut off and carted to the threshing-floor. The stalks (*karbi*) are then bound into sheaves which are carefully stacked. The heads are threshed in the ordinary way under the feet of bullocks. Sometimes the heap is made of larger diameter than usual and the bullocks are driven round yoked to a cart, the pressure of the wheels helping to separate the grain. In Madras, especially in the Bellary District, ordinary stone road-rollers are used for threshing *jowār* and do effective work. The grain is sifted from the chaff in the wind and subsequently cleaned with a hand riddle or *sūp*.

In the Deccan an average crop of *kharīf jowār* will vary, according to the quality of the soil, from 500 to 900 lb. per acre, with 100 to 200 lb. of subordinate pulses and 350 to 450 bundles of *karbi*. A small bundle of *karbi* weighs about 3 lb. and a large bundle 7 or 8 lb.

The *rabi* crop.

For *rabi jowār* the land is prepared with the plough and the scarifier during the rains, usually receiving the careful preparation already described for wheat. The crop is sown alone, or with subordinate rows of safflower, gram, or linseed. The seed rate per acre is 6 to 8 lb. of *jowār* and 1 or 2 lb. of the other seed. A heavy two or three-coultered drill is used for sowing, and the rows are 16 to 20 inches apart. The seed is sown in September–October, and harvest comes in February or March. The ears are generally cut off the standing crop, and the stalks, after a few days, are reaped or pulled by the root. A good *rabi* crop on black soil will yield 600 to 700 lb. per acre of *jowār* and 100 lb. of safflower.

Exports.

Jowār and *bājra* are very important food-grains in India, but are not at any time extensively exported, and very little is sent away in years of scarcity or famine. The exports in 1903–4 amounted to 2,000,000 cwt., valued at 71 lakhs.

Pulses. Gram areas.

Gram or chick-pea (*Cicer arietinum*), which we may take as the specimen pulse crop, is sometimes styled Bengal gram, to distinguish it from *kulthi* or *khulāt* (*Dolichos biflorus*), which is

known as gram or horse gram in Madras. Its cultivation in India is ancient. It is a low-growing feathery plant, with, usually, small pink flowers. There are four varieties in common cultivation, which differ chiefly in the colour of the seed. The colours are black, dark red or reddish brown, yellow, and white or creamy white. The plants producing the first three are generally grown indiscriminately together. The plant which yields white seed has white or light-coloured flowers, and is larger but less productive than the others.

Gram occupies normally about 15,000 square miles, the areas actually sown varying with the character of the late rains. The United Provinces grow about half the total area, and the crop is important also in the Punjab, Bengal, Bombay, and the Central Provinces.

Cultivation.

Gram is always a *rabi* crop. It is extensively grown on black soil as a 'dry' crop, and is there usually the sole crop of the year. In the alluvial tracts of the north it grows well on the heavier soils without irrigation, but is irrigated in districts of very light rainfall, and also in specially dry seasons. It is often grown as a second crop, when it receives only rough cultivation, but yields well if there is sufficient moisture in the soil.

Gram is most generally grown alone, except in the north, where it is commonly mixed with wheat or barley. In black soil it is sometimes sown mixed with wheat or with subordinate rows of linseed or safflower.

Gram is everywhere recognized as a valuable rotation crop, being, like other leguminous crops, restorative to the soil. A good crop is dense and shades the ground, and thus suppresses weeds. The land is left clean, and the succeeding crop benefits to a considerable extent.

Gram and wheat are interchangeable according to the character of the season, and both crops receive the same sort of preparatory tillage. The land should be ready for sowing by the middle of September. In the north of India the seed is sown like wheat, or broadcast; on black soil a heavy two or three-coultered drill is used for sowing. The seed rows are generally a foot or less apart. Gram should be sown first of the *rabi* crops, as it requires a warm and moist seed-bed. A crop sown in October ripens from February to April, and in the interval it rarely requires weeding or any other attention.

When the seedlings begin to branch and before flowers are produced the leading shoots are sometimes nipped off, to make

the plants bushier and more productive. The cuttings are eaten as a vegetable.

Harvest and out-turn.

Gram as it ripens changes to a rich yellow-brown colour, and many leaves drop off and litter the ground. It is reaped with a blunt sickle and is generally uprooted. The fine chaff makes excellent fodder. It has an acid taste, and, if mixed with the *bhūsa* of wheat, gives the whole mass an agreeable flavour which cattle like.

In black soil 'dry' crop gram yields on an average 500 to 600 lb. of pulse per acre. The out-turn from an alluvial soil is higher, averaging 700 to 800 lb. per acre, but is greatly influenced by the amount of winter rain, especially in January.

Exports.

Gram and other pulses are largely eaten in all parts of India, and exports are not extensive. In 1903-4 the pulse exports amounted to 2,500,000 cwt., valued at 91½ lakhs.

Oilseeds.

The statistical returns give an average area of about 19,000 square miles under oilseeds. Bengal has about one-third of the whole, while Bombay, the Central Provinces, and Madras grow annually about 3,000 square miles each. Oilseeds are largely grown in other Provinces, mixed with other crops, for local consumption.

Exports.

The exports of oilseeds averaged 16,750,000 cwt., valued at about 11 crores, during the ten years ending with 1899-1900. In 1903-4 the figures were 24,500,000 cwt., valued at 14½ crores. The most prominent oilseed crops are sesamum, linseed, rape, mustard, castor, and ground-nut.

Linseed.

Linseed (*Linum usitatissimum*) is found wild between the Persian Gulf and the Black Sea, and may have been introduced into India by the Aryans. Here it is grown chiefly for its seed, which is valuable on account of the oil extracted therefrom and because the oilcake is a very important cattle food. In more temperate countries this plant is grown for its fibre (flax) as well as for its seed. Experimental efforts have been made to extract flax from the Indian plant, but without much success.

Linseed is an erect annual. A mature crop stands from 1½ to 2 feet high: the stems rise some distance from the ground and then branch freely. The delicate colouring of the pale-blue flowers is very striking. The fruit is a rounded capsule, with ten divisions and a single seed in each. The seeds are smooth, shining, oval, and flattened, and are commonly a rich mahogany brown in colour. A variety with creamy white seed is sparingly cultivated.

Production.

Nearly 5,000 square miles of linseed are grown in India.

The crop is most important in the Central Provinces, with an average cultivation (including Berār) of about 1,600 square miles. It is also extensively grown in Bengal, the United Provinces, and Bombay.

Though linseed holds only the third position in point of area among the oilseed crops, being in this respect of less importance than sesamum and rape, it is much more largely exported than the others. Between 1898–9 and 1903–4 the exports ranged from about 5,000,000 to nearly 9,000,000 cwt. The production of linseed depends largely on local food necessities, the prices ruling in Europe, and the relative value of linseed and cotton for the time being.

Linseed is grown only in the *rabi* season, chiefly on deep moisture-holding black soil, or on clay soils in the alluvial tract. It is generally grown alone, except in parts of Bengal and the United Provinces, where it is mixed with wheat, rapeseed, and various *rabi* pulses. Unless taken as a second crop in rice-beds, linseed is usually the sole crop of the year. When grown on black soil the land is prepared in the same way as for wheat. A clean friable seed-bed should be ready by the end of September, and in October the seed is drilled at the rate of 10 to 12 lb. per acre. A light drill is used, with coulters one foot apart, and the seed should not be covered deeply. If there is sufficient moisture for successful germination, the crop will on deep black soil reach maturity with very little rainfall. It is reaped from February to April, before it is dead ripe. The seed falls easily from the dry plants, and so the crop is carried as expeditiously as possible to the threshing-floor. It is separated by beating with a stick when the plants have been fully dried in the sun, and is winnowed in the usual way. Cultivation.

A good harvest of linseed on deep black soil will yield about 500 lb. of seed per acre, but the crop is precarious and often produces less.

Sesamum, or gingelly (*Sesamum indicum*), is found wild in Java and is probably indigenous in India also. It is an annual herbaceous plant, $3\frac{1}{2}$ to $4\frac{1}{2}$ feet high when full grown. The stems are erect, but branch freely if the plants get room. The fruit is a four-celled capsule which when ripe opens at the top. The seeds, which are numerous, are oval, flattened, and either shining white, grey, reddish brown, dark brown, or black according to variety. Some kinds are specially suitable for sowing on fairly light soils in the *kharīf* season, while other varieties grow better on heavier soil, as early *rabi* crops. Sesamum.

About 6,600 square miles are grown with sesamum in India. Bengal had the largest average area for the ten years ending 1899–1900. Sesamum is also widely grown in the Central Provinces, Burma, Madras, the United Provinces, and Bombay.

Cultivation.

The *rabi* crop is extensively grown on black or medium black soil, where it alternates with cotton and *jowār*. The sesamum year affords a good opportunity of thoroughly cleaning the land during the monsoon, as the sowing is done in September. A clean, friable, firm seed-bed is obtained by ploughing and scarifying between June and August. The seed is sown broadcast or drilled in rows which are from 12 to 18 inches apart, being widest on deep black soil, which generally produces a vigorous plant. The seed is small and is mixed with ashes or fine earth to secure even distribution in sowing. The seedlings, which should be thinned out when about 6 inches high, are delicate at first and are often destroyed by heavy rain. Hand-weeding and bullock-hoeing are necessary. If sown in September the crop is ready by January. When it is ripe, the leaves turn yellow and the capsules are mottled with black spots. The *kharīf* crop is usually mixed with other crops, such as *jowār*, *bājra*, and cotton, but is sown by itself in some localities. It ripens in October or November.

Harvest and out-turn.

It is best to harvest the plants by uprooting them, and they should then be shaken over a large cloth. The seed of such capsules as have opened is thus collected. The plants are tied into small bundles which are carted the same day to the threshing-floor, where they are stacked close together on their root ends. In the course of a fortnight the capsules open fully, and will empty themselves if each bundle is inverted and gently beaten with a stick. The winnowing is done by wind in the ordinary way, and completed by means of the *sūp*, which, if deftly handled, will separate all small particles of dust and other impurity. The stalks and chaff have no fodder value.

A good average sesamum crop from black soil gives about 450 lb. of seed per acre; but the out-turn is often less, as the crop, like linseed, is delicate and liable to many mishaps.

White sesamum is prized for the preparation of native sweetmeats. Sesamum cake is an excellent cattle food, while the oil is largely used in native cookery.

Other oil-seeds.

The other oilseeds of India are chiefly rape-seed (produced principally in the Punjab, United Provinces, and Bengal); castor (castor-seed is exported from Bombay; castor-oil from Bengal); ground-nuts (produced in Southern India); and poppy-seeds and coco-nut-seed (the export of the last is almost

exclusively from Madras). The export of oilseeds in lieu of the expressed oil is from an agricultural point of view not altogether satisfactory, as the manurial constituents are thus lost to the soil.

Sugar-cane.

Indian sugar is produced from sugar-cane, and also to a considerable extent from the bastard date and palmyra palms. Sugar-cane (*Saccharum officinarum*) is a perennial grass with thick, solid-jointed, juicy stems, which are usually 8 to 12 feet high. The leaves are long and wide, and the lower ones die down long before the crop is ripe. The inflorescence is a large, graceful, feathery plume. Some varieties flower regularly, others rarely, and the seeds seldom form. Sugar-cane is essentially a tropical or sub-tropical crop.

A very large number of varieties of sugar-cane are cultivated in India. They may be broadly grouped into (*a*) thick, juicy, soft kinds, which ordinarily require very liberal cultivation and irrigation; (*b*) thin, hard, less juicy kinds, which, with well-distributed rainfall, succeed with less liberal cultivation, and with sparing irrigation or even with none. The canes of the different varieties vary in colour. The colours are yellow or green, or both; purple; purple and yellowish green in stripes; and purple and green mixed. Canes vary in many other characteristic ways.

Areas of production.

The statistical returns for 1903–4 show the total sugar-cane cultivation in British India at 3,600 square miles, against an average of 4,400 for the ten years ending with 1899–1900. The Provincial areas were 1,700 square miles in the United Provinces, 1,000 in Bengal, and 500 in the Punjab. The areas in other Provinces are trifling in comparison. The crop is everywhere irrigated, except in parts of Bengal. Cultivation has declined during recent years in Bombay and the Central Provinces, where the necessary irrigation is much more costly than in the north of India.

In the alluvial tracts, where the crop is extensively grown, the most suitable soils are good firm loams or light clays. The irrigated crop adapts itself to any description of soil of fair depth, if drainage is secured by a pervious subsoil or otherwise. A water-logged soil is fatal to successful cultivation.

Cultivation.

Sugar-cane is commonly called a twelve months' crop, but on an average occupies the land only ten or eleven months. The most common season for planting is February and March, but this may be done a month or two earlier or later. Planting in the hot weather is not generally successful, as the young shoots suffer from the hot sun.

The crop is generally propagated from sets or cuttings, and sometimes by planting whole canes. The sets consist of pieces of cane, each with three eye-buds, and generally about a foot long. A deep friable tilth is required, which is obtained by repeated ploughings during several months. Beds of 10 feet square or larger are formed for irrigation. The sets are planted in a variety of ways. Pits are sometimes dug, 4 inches deep, in straight rows 2 feet apart, and one set is planted in each pit. The sets when carefully covered with soil are 6 inches apart in the rows. Irrigation is given immediately after planting. In some places, after the land has been well prepared and manured, it is ploughed into ridges and furrows. Beds are then formed for irrigation and the sets are planted in the furrows. This is sometimes done by flooding the beds and trampling the sets one by one into the soft mud. From 12,000 to 16,000 sets are required per acre.

Sugar-cane requires constant attention during the first four to six months of its growth. Soon after planting hand-weeding is required, which is repeated as often as necessary. Digging between the rows with a light pick is beneficial. As the crop acquires height the canes should be supported by earthing them up: this is done four or five months after planting. An extra dressing of manure is now often given, castor-cake and other oil-cakes being most suitable. The canes, originally planted in flat beds or in furrows, are earthed up with a hand hoe so as to form ridges, the furrows between which serve as water channels for further irrigation. The ridges also give support to the cane, so that it is not lodged by the force of wind or rain. Cane when lodged yields a smaller percentage of crystallizable sugar.

Cane is trashed by removing all dead side-leaves, so that air gets freer access to the crop. Wrapping the cane in its own dead side-leaves, though costly, is required where rats, jackals, and wild hog are numerous and destructive.

Sugar-cane makes slow progress during the first three or four months; and subordinate crops which ripen quickly, such as maize, green onions, cucumbers, and melons, are commonly grown with it. When the sugar-cane shades the ground it requires no further attention except regular irrigation until it is harvested.

Ratoon cane.

A ratoon crop is one grown from the root stocks of the previous crop. Some varieties are much more successfully ratooned than others. Ratooning is sometimes profitably

continued for several years, but not when weeds or fungoid diseases or insect pests become established.

It is difficult to judge accurately when sugar-cane is ripe for sugar-making. The chief product in India is crude sugar (*gur* or *jāgri*), which is, in many parts, valued on account of its adaptability for native sweetmeats and native cookery. The soft canes are largely used for chewing, and are sold in towns and villages, or by the roadside, or at railway stations, to travellers. The ripeness of the cane is tested by a trial boiling. If so many measures of juice give a satisfactory weight of *jāgri*, harvesting operations are proceeded with; otherwise the work is postponed. If it is intended to grow a ratoon crop, the cane should be cut with a sharp sickle one or two inches above the ground; otherwise each cane is uprooted by a sharp jerk. The dry side-leaves are stripped off with a sickle and the green top-leaves removed for fodder. The cane is tied into head-loads and carried to the mill. Harvesting.

The juice is now usually expressed in iron mills worked by bullocks, which have superseded the wooden or stone mortars formerly used. The European firm of Mylne of Bihiya, in Bihār, was among the first to introduce improved iron mills. The methods of boiling the juice and the nature of the final product vary considerably, but as a rule it is boiled in a shallow iron pan over a furnace built of mud, the dry leaves and crushed canes being used as fuel. Much skill is required both in regulating the temperature and in clarifying the boiling juice by means of various decoctions, and in some parts of the country the operations are carried out by professional sugar-boilers. Crushing and boiling.

In the north of India and in Bengal 20 tons of cane per acre is considered a good crop, and an out-turn of $1\frac{1}{2}$ to 2 tons of *gur* per acre is obtained. In Peninsular India, where sugar-cane is extensively grown under well-irrigation and is very highly manured, the product is much higher, 6,000 to 7,000 lb. of *gur* per acre being an ordinary out-turn. With very careful cultivation and high manuring, even double that yield has been obtained from soft varieties of cane. Out-turn.

The history of the Indian sugar trade is instructive. The arts of preparing, refining, and crystallizing raw sugar have been practised from ancient times, though it is probable that the knowledge of some of the stages of manufacture may have been derived from China. When the East India Company began to export this substance from India to England, their transactions were confined to the finer qualities of crystallized Trade in refined sugar.

sugar, procured from Bengal. Restrictions were, in fact, placed by the Company on the traffic from Madras and Bombay, it being desired that Bengal should be accepted as the Province from which sugar and silk could best be procured. In course of time, however, the British Government found cause to grant special favours to the sugar-planters of the West Indies. An import duty was accordingly imposed on Bengal sugar, at such a high rate as to render the Indian traffic no longer profitable. This state of affairs continued till about 1845, when the establishment of large refineries in Great Britain created a demand for raw sugar. This new traffic was first organized with Madras; but, soon after refineries on European methods and with European capital were established all over India. These for some time successfully contested the Indian markets against imports; but gradually India exported less sugar and imported more, so that in 1903–4 the exports were trifling as compared with the imports. The imports of refined sugar in the latter year amounted to nearly 6,000,000 cwt., valued at $5\frac{1}{2}$ crores. This state of things has resulted from the development of beet-sugar in continental Europe and the stimulation of its export by bounties[1], and also from the increasing export of cane-sugar from tropical countries such as Mauritius and Java. Refined sugar is rapidly tending to push out the crude stuff formerly consumed by the people.

In 1896 India possessed 236 sugar factories and refineries and in 1900, 203 factories employing about 5,000 persons. The smaller concerns are no longer registered, but in 190[illegible] there were twenty-one large factories employing 4,900 hands.

Cotton.

Cotton (*Gossypium*) is chiefly grown in tropical and subtropical countries. Various species are found wild in India the forms which are in general cultivation are very numerous and a good many kinds of perennial or tree cottons have been found near Hindu temples and in gardens. Comprehensive investigations are now (1905) in progress, to determine the characteristics and comparative values of the numerous indigenous varieties and their suitability for different descriptions of soil and climate. The improvement of indigenous varieties through the selection of seed, and by cross-fertilization and selection, is also progressing satisfactorily on Government farms.

[1] In regard to the countervailing duties imposed on bounty-fed beet sugar imported into India between 1899 and 1903, see Vol. IV, chap. vii Miscellaneous Revenue (Customs).

The numerous indigenous kinds in general cultivation can probably be referred to *G. herbaceum*, *G. neglectum*, *G. roseum*, and *G. arboreum*. They may be more broadly grouped into (*a*) varieties which take at least eight months to come to maturity, and (*b*) varieties which ripen in about five months.

Late-ripening varieties.

The varieties of the first group are grown as 'dry' crops, and are suited only for districts which possess deep moisture-holding black soil or which have a prolonged rainy season. These late-ripening varieties would, in most seasons, fail in the north of India, where the December cold would arrest or destroy growth. The plants are bushy and prolific. The length, quality, and percentage of lint are fair or good, according to local conditions. The majority produce lint which is suitable for yarn of twenty to forty counts[1]. The proportion of lint to seed is over 40 per cent. in the best Broach, and under 25 per cent. in the worst Madras varieties. Inferiority is largely due to impoverished soil, careless cultivation, and neglect in selection of seed.

Early-ripening varieties.

The varieties included under group (*b*) are much more numerous than those included in (*a*), and are generally grown mixed in far greater confusion. They are widely cultivated in every Province except Madras. With the exception of a very few varieties of the Hinganghāt or Bani type, they produce cotton which is short and coarse, but pure white in colour. The coarsest and shortest of this cotton is suitable for mixing with wool, and for this purpose is at present worth more than cotton of better quality. It is in keen demand for export to Japan and the continent of Europe. The proportion of lint to seed in the coarse varieties is high, ranging from 30 to more than 50 per cent. In almost all varieties the plants are tall with few side-branches and flowers, and individually are not productive. The cultivation of varieties producing inferior lint has extended, because they are hardy and can be grown on light soil, which is unsuitable, without irrigation, for the late-ripening finer varieties of the Broach type. The quick-ripening varieties can be grown without much risk in years of short rainfall, and good yields are obtained in average years.

The Provincial Agricultural departments have recognized that the cultivation of the inferior early-ripening cottons will continue, and may extend, until superior varieties are found which can be grown as quickly without risk and be more profitable in average seasons. The experiments in cotton

[1] Cotton yarns are said to be of 20's, 30's, &c., counts when not more than a like number of hanks of 840 yards go to the pound avoirdupois.

improvement by cross-fertilization and otherwise, now being conducted by the various Agricultural departments, are directed to solve these difficulties. It may be mentioned that at the time of the American Civil War attention was turned to India as a source of the cotton supply; and that several 'cotton farms' were established for the improvement of Indian cotton, under the charge of men sent out from England who were, however, as a rule, merely gardeners. After the war was over the cotton trade returned to its normal state, and the 'farms' then became Government experimental and model farms, and were transferred from the former Cotton Commissioners to the Provincial Governments.

Deterioration of Indian cotton.

It is often stated that the cultivation of cotton in India has deteriorated in recent times. As already observed, the growing practice of separating the seed from the fibre in ginning factories, instead of as formerly by hand gins, has tended to injure the quality by mixing up seed, in many parts of the country. There can be no improvement unless the seed sown is at least equal to the average of the previous crop. The plant which produced lint suitable for the historic Dacca muslins does not now exist, or has greatly deteriorated. The Hinganghāt cotton of thirty or forty years ago was longer and silkier than that which is now produced, while Broach and Surat cotton are considered by some not to have maintained their ancient reputation, although higher cultivation is practised in those districts than elsewhere in India.

Exotics.

The only exotic cotton which is cultivated to any appreciable extent in Madras is Bourbon cotton. It was introduced more than 100 years ago, and is now raised upon a few thousand acres in the Coimbatore District. The crop is not grown unmixed, and the lint sells at less than other Madras varieties. An acclimatized American variety has been grown for more than thirty years in the Dhārwār District of Bombay. Its cultivation was at one time extensive, but is now declining. 'Upland Georgian' has been thoroughly acclimatized at the Nāgpur Government farm, and a stray plant can be seen here and there in many fields in the Central Provinces; but there is no general cultivation. Several varieties of the 'upland' type have been acclimatized on the Cawnpore farm, but their cultivation has not extended in the United Provinces. Native cultivators have not taken kindly to exotics because, even when acclimatized, they are more risky to grow than indigenous varieties, being liable to damage from insect attack, heavy downpours of rain, drought, and the like. Acclimatization also

causes deterioration of the lint. Experiments have, in short, proved that newly introduced exotic varieties do badly, or fail, on black soil in any part of India, and, in an unfavourable season, succumb far sooner than indigenous varieties in any kind of soil. The adaptability of exotic varieties when acclimatized may possibly be proved for the drier portions of the Indo-Gangetic plain, where, as in Bihār, the rainfall is moderate and well distributed, or where, as in wide areas of the United Provinces, the Punjab, and Sind, deficient rainfall can be supplemented by cheap irrigation. Exotics do much better on alluvial than on black soil.

About half the total area under cotton, or say 8,000 square miles, is in Bombay and Berār; the other half consists mainly of about 1,600 square miles each in Madras, the Central Provinces, the United Provinces, and the Punjab. Bengal, Assam, Burma, and Sind have each, in normal seasons, not more than about 160 square miles under cotton. The area in Berār and the Central Provinces proper has rapidly extended in recent years. Areas of production.

In Peninsular India the most suitable soil for cotton is the black cotton soil, which is a deep dense clay. The crop is also extensively grown on mixed black soils of no great depth. The most vigorous and productive crops are grown on the deep black soils of Broach and Surat. The cotton plants which grow on the impoverished black soils of Madras are poor in comparison. The alluvial soils in the Indo-Gangetic plains produce larger plants and a greater out-turn than the black soils of any part of India. Soils, &c.

On black soil cotton is usually grown alone, or with lines of *arhar* (*Cajanus indicus*) or *jowār*. On alluvial soil it is commonly mixed with *arhar* and maize or *jowār*. In the alluvial tracts there is no systematic rotation. On black soils *jowār* is the principal rotation crop, and cotton is usually grown every second year.

In the most backward parts, cotton is sown broadcast on land carelessly prepared, and receives little weeding; but in the best cotton tracts the cultivation is most careful, reaching its highest form in the Broach and Surat Districts of Bombay. For good cultivation tillage begins, usually in the hot weather, by working a heavy scarifier which grubs up the stubble of the previous crop, scrapes the surface, and fills in the cracks. Such manure as may be available is applied in May. The plough is used after the first monsoon rain, and is usually worked several times, preparatory tillage being completed expeditiously to Cultivation.

admit of sowing in June. A two-rowed drill, with coulters 20 to 22 inches apart, is used for sowing. The seeds, owing to the fuzz on them, cling together, and are prepared for sowing by mixing with a thin plaster of cowdung, mud, and water, which when dry passes readily through the seed-bowl and tubes of the drill. The usual seed rate is 10 to 15 lb. per acre. The seed is drilled in accurately straight equidistant rows. On account of damage from rain on the heavy black soil, two or more sowings are often necessary before satisfactory germination is secured. The crop is generally hand-weeded once or twice. Inter-culture with the bullock-hoe begins when the seedlings are about 4 inches high. The weaklings are thinned out gradually; and finally the strongest plants are left 18 inches or 2 feet apart in the rows if the crop is healthy and vigorous, but much closer if the young plants are backward or stunted from any cause. The final operation is to pass the plough between the rows in September–October. This prevents the black soil from cracking too early, and thus helps to conserve moisture.

Out-turn.

The plants begin to produce flowers in October–November, and cotton-picking begins in January and lasts until March or April. Four or five pickings are necessary. The second and third are the most important, and from these the best seed for the following season is obtained. An average yield from liberally cultivated black soil is about 400 lb. of *kapās* (seed and lint) per acre. In the Deccan the out-turn is much less; and in the alluvial tracts of the north of India, particularly with canal-irrigation, it is considerably higher. The cotton as picked yields probably on an average throughout India 20 to 33 per cent. of lint.

Exports.

The exports during the ten years ending with 1899–1900 averaged about 4,700,000 cwt., valued at nearly 12 crores; and in 1903–4, the highest year on record, they were nearly 8,000,000 cwt., valued at 24 crores, production and prices having been increased by a good season in India and a shortage in the American crop. Most of the cotton goes to Japan and Germany.

A considerable export of cotton seed has sprung up quite lately, a large demand for Indian seed having developed in the United Kingdom owing to the high prices for Egyptian seed in 1901. In 1903–4 the exports of cotton seed amounted to more than 2,500,000 cwt.

Jute.

Two species of jute (*Corchorus*) are cultivated in India, *C. capsularis* and *C. olitorius*. The fruit of the former has

a short rounded capsule, while that of the latter is elongated. The varieties of *C. capsularis* are more numerous than those of *C. olitorius*, the former being conspicuously wanting in permanency.

There is a general belief that the fibre of *C. olitorius* is inferior to that of *C. capsularis*; but this cannot be substantiated, as the superior varieties of both species yield excellent fibre if properly extracted. It is believed that the differences between the varieties have been induced by local conditions of soil and depth of water, and to a considerable extent by natural cross-fertilization. Some of the races of each species have purple-red stems, others green stems. The red colouring, where it exists, extends to the petioles of the leaves. The red-stemmed races are popularly believed to give inferior fibre to that of the green-stemmed varieties, but this is not certain.

Areas of production.

The jute crop is important only in Bengal. The statistical returns show for that Province an average area of 3,000 square miles during the ten years ending 1899–1900, and 3,800 square miles in 1903–4. It is believed that these figures are below the truth, and that the actual area now grown in Bengal does not fall far short of 4,700 square miles. Small but increasing areas are cultivated in Assam and Nepāl, and there is some trifling production in Burma and the Frontier Province.

Soils.

Jute is chiefly grown on land which is liable to be submerged when the plants have made some progress, for it is an exhausting crop on soils which are not benefited by inundation silt. Very good jute can, however, be grown on fairly high land in Bengal, provided the cultivation is liberal, and there is sufficient water or dampness during the whole period of growth. The conditions which are suitable for rice are usually suitable for jute also; and its cultivation will probably extend in the rice tracts of Burma and Assam, and possibly also in the deltaic areas of Madras.

Cultivation.

Tillage begins when the soil has been softened by the spring showers. The land is worked three or four times with a light plough, and is then levelled and made smooth with a plank or bamboo 'ladder.' The land should be clean and brought to a fine tilth, and should have the same degree of moisture as is required for the successful germination of any ordinary 'dry' crop. The crop responds to liberal manuring. Seed is sown broadcast in April and May at the rate of 8 to 12 lb. per acre. The levelling 'ladder' is again used after sowing to cover the seed and smooth the surface. When the

plants are 4 inches high, a bullock harrow, with teeth 6 inche apart, is used to thin and weed the crop, and to loosen th soil. The weeding and thinning are completed by hand, an hand-weeding is repeated as often as required. The plant are left 4 to 5 inches apart. They grow rapidly; and a goo crop is very dense, stands 10 or 12 feet high, and smother all weeds. It is probable that if the plants were thinned ou more than is usually done, they would yield good fibre, and when ripe, better seed than the plants of a thickly sown crop Labour moreover is saved in extracting the fibre from thick stems, as the bark is more easily stripped off after steeping.

Harvesting.

Jute should be cut for fibre before it is fully ripe. Harvest ing should not be delayed after the fruits set, and may possibly be done earlier with advantage. The stalks are reaped nea the ground, and tied into bundles of moderate size, which are stacked on end in the field, in a close round heap, for a few days. The weight of green crop per acre is so heavy that it cannot be carried far to be 'retted' (steeped). It is usually placed in the nearest water-hole, which is used over and over again for successive steepings. The water thus becomes pol luted with decaying organic matter, and the colour and quality of the fibre are thereby impaired. The bundles of stalks are heaped in the water, and kept completely submerged by weights. In close warm weather the 'retting' is complete in about twenty-one days, and the bark is then easily stripped from the stems by hand. The clean fibre is separated by wash ing in water, and beating. The commercial value of the fibre depends upon colour and lustre, strength, length, fineness, and absence of roots. Difference in these qualities may, under present conditions, cause a difference in price of Rs. 2 or more per maund of 82 lb. The fibre is bought from the cultivators by petty middlemen, who pass it on to wholesale dealers. The jute is finally steam-pressed for export into bales, which weigh 400 lb. each.

Out-turn.

The popular estimate is that an acre of jute yields three o such bales; but the actual out-turn is probably higher, a experiments have proved that a really good crop yields from 2,400 to 2,600 lb. of clean fibre per acre.

Complaints have been made of late years that jute has de teriorated; but it is fairly clear that the alleged deterioration is due to fraudulent watering, and other malpractices in the trade, after the crop has been reaped and 'retted,' rather than to degeneration of the plant.

Exports.

Jute is now extensively utilized in Indian mills (*vide* chap. iv

Arts and Manufactures). The exports of raw jute in 1903–4 amounted to nearly 14,000,000 cwt., valued at about 12 crores.

The tobacco plant was introduced into India by the Portuguese about the year 1605. As in other parts of the world, it passed through a period of persecution, but its ultimate distribution over India is one of the numerous examples of the avidity with which advantageous new crops or appliances are adopted by the Indian agriculturist. Five or six species of *Nicotiana* are cultivated, but only two are found in India, namely, *N. Tabacum* and *N. rustica*. The former is a native of South or Central America, and is the common tobacco of India. The plant, when allowed to grow to seed, is 5 to 7 feet in height. The leaves at the base of the stalk are very large; the rest become gradually smaller towards the top. Flowers appear as terminal panicles and vary in colour from white to pink. The fruit is an egg-shaped capsule, containing numerous very small pale-brown seeds of irregular shape. The races cultivated in India are numerous. Tobacco.

N. rustica is cultivated in parts of the Punjab, the United Provinces, Bengal, and Assam. It is a lower plant than *N. Tabacum*, and has rather rounded, crumpled leaves, with thick stalks, pale-yellow flowers, a globular capsule, and oblong seeds which are larger than those of *N. Tabacum*.

The statistical returns for British India give the average area under tobacco for the ten years ending 1899–1900 as approximately 1,700 square miles. It is believed, however, that the actual cultivation is much higher than these figures indicate. More than half the recorded area is in Bengal; the other chief centres of cultivation, in order of importance, are Madras, Bombay, Burma, the Punjab, and the United Provinces. Areas of production.

Tobacco is successfully grown on various kinds of soil, the heaviest crops being produced on alluvial or clay loams situated near villages or on old village sites. Good crops are also raised on mixed black soil which has natural drainage. Soils, &c.

In various parts of India the crop is successfully grown by irrigation with well water containing nitrates. In some places this irrigation supplies about 500 lb. of nitrate of potash per acre. In parts of Gujarāt tobacco has been grown continuously for many years without any manure except that derived from such irrigation, and very heavy crops of strong coarse tobacco are still produced annually. Mild-flavoured tobacco of good quality cannot, however, be grown with irrigation from salt wells. Tobacco is often produced for several years

in succession on the same land: this encourages parasites of th broom rape family, which often do great harm.

Cultivation. Seed-bed. The crop is grown from transplanted seedlings. The seed bed requires careful preparation, and should be sheltere from heavy showers of rain. The seedlings when young ar very delicate, and require protection from sun and storms A seed-bed 15 feet by 10 will supply seedlings sufficient for a acre. It is a good plan to dig the seed-bed in the hot weather an burn it with straw, grass, waste litter, brushwood, or cow-dung The ashes manure the soil and the heat kills weeds and insects Sheep or goat droppings should be applied, and as fine a tilt as possible obtained by digging. The seed, mixed with ashes t secure even distribution, is generally sown in July or August but in some Provinces later. Weeding and thinning out ar necessary, and caterpillars must be diligently looked for an destroyed every morning.

Transplantation, &c. The main field requires thorough tillage, and should be in fine state of tilth when the seedlings are ready for transplanta tion. The plough is used repeatedly between June and August manure being applied when the field has been several time ploughed. About thirty cart-loads of well-rotted manure pe acre are usually given. In Bihār heavy crops are obtaine by a similar application of *sīth* (indigo refuse), or by irrigatin the land before planting with the drainage of indigo vats Fields intended for tobacco are often closely folded with shee and goats in the fair season with excellent results.

The seedlings are ready for transplantation when they hav four leaves and are 4 to 5 inches high. They are then plante about 20 inches apart in straight rows, with the same distanc between the rows. Only seedlings with straight stems and well developed roots are selected. Planting is most successful whe done on a cloudy afternoon. Light rain for a few days afte transplantation is very beneficial, and it is a good plan to cove each seedling lightly with twigs and leaves of the *nim* tree Much of the success of the crop depends upon careful trans plantation.

Bullock-hoeing should begin when the plants have made fair start, and should continue as long as the bullocks do no injure the plants. A good deal of hand-weeding is als required.

The plant is left untopped when small golden leaves ar required for special purposes, but it is usually 'topped' b removing the flower-bud and a few of the youngest leaves From twelve to fourteen leaves are usually left on each plant

Topping causes the plant to throw out side-shoots, which are generally called 'suckers.' These should be removed in order to concentrate the strength of the plant on perfecting the leaves. The field must be worked over many times in the season to remove such suckers.

In some districts irrigation is not required, but a well or other water-source is generally at hand to be used if necessary. Where irrigation is practised, the first watering is, in Northern India, generally given in November and December, and at intervals of two or three weeks afterwards until the crop ripens about February or May, according to the time of sowing.

The crop is ready for harvesting when the leaves become brittle and crumpled and covered with yellow spots. The whole plant is usually cut down and dried in the sun, but in Bombay the leaves are stripped one by one with a small sharp sickle. The after treatment of the leaves depends upon whether black or yellow tobacco is manufactured.

Black and yellow tobacco.

Black tobacco, used for smoking in the *hukka*, is made in some districts as follows. The leaves, when stripped off the stems, are laid in threes, one above the other, on the ground, being arranged in overlapping rows like slates on a roof. They are left thus, exposed to sun and dew, for four days, and in the absence of dew are artificially damped. This half-dried tobacco is built into heaps and, when it has heated slightly, is tied into bundles, which are again put into heaps and subjected to gentle fermentation. The heaps are turned every second day for a fortnight, when the tobacco ought to be cured and becomes dark brown or nearly black in colour.

Yellow tobacco is prepared differently. Two days before the crop is cut the field is irrigated. The whole plants or stripped leaves are laid on the ground, where they lie exposed to sun and dew for eight days. The moist earth prevents rapid drying, and the leaves assume a bright yellow colour. They are tied into bundles when almost dry, and only slightly ferment when stored. The tobacco matures slowly and, when ready for sale, has a yellow-brown colour.

Very large crops of inferior yellow tobacco can be obtained with irrigation from salt wells, the out-turn of cured leaf being sometimes as high as 3,000 lb. per acre. An ordinary crop of tobacco is from 1,200 to 1,500 lb. per acre of cured leaf, but heavily manured crops yield much more.

Manufacture and trade.

About the year 1829 experiments were conducted by the East India Company towards improving the quality of leaf and

perfecting the native methods of curing and manufacturin tobacco. These were often repeated, and gradually th industry became identified with three great centres: namel (1) Eastern and Northern Bengal (more especially the Distri of Rangpur); (2) Madras, Trichinopoly, Dindigul, Cocanād and Calicut in Southern India; and (3) Rangoon and Mou mein in Burma. Bengal is, as we have seen, the chief tobacc growing Province, but little or no tobacco is manufacture there. Several unsuccessful efforts have been made to organiz a cigar manufacture, but on each occasion (as it would seem) i the least hopeful parts of the Province. The bulk of the lea is exported in the crudely cured form above described to foreig countries, or is carried to Burma to be made into cigars, bein there mixed, as a rule, with Burma-grown tobacco. In Southern India a fair amount of superior tobacco is grown and cured, bu interest chiefly centres in the successful cigar production o the Madras Presidency. In 1903 there were about twenty farm and factories concerned in the manufacture of tobacco, whic employed nearly 2,000 persons.

Perhaps the earliest mention of exportation of tobacco fron India occurs in the year 1825. By 1866–7 tobacco ha assumed the position of a recognized article of export, bein then valued at 5½ lakhs. The subsequent returns manifest continuously expanding trade, which in 1903–4 stood a 21 lakhs. But the most significant feature of this prosperit is the steady growth of the demand for Indian and Burmes cigars. In 1886–7 the cigar trade was valued at two, i 1896–7 at six, and in 1903–4 at eight lakhs; and it ma confidently be assumed that the next decade will witness a con tinued rate of expansion, as the moderate price of Indian ciga becomes more widely known in Europe. It must be note however, that the imports of tobacco into India (50 lakhs i 1903–4) still exceed the exports, and are advancing. This i mainly due to an increasing import of cheap cigarettes, princ pally from the United Kingdom.

Poppy.

The opium-yielding poppy (*Papaver somniferum*) is believe to be a cultivated form of *P. setigerum*, a species which grow wild on the shores of the Mediterranean. The opium popp is an annual, from 2 to 4 feet high. The most common variet cultivated in India has white flowers, but red or purple-flowere kinds are also grown. The seeds in each capsule are small an numerous, reniform, and white or black in colour.

Areas of production.

Poppy is grown in some Native States, principally in Indor Gwalior, Bhopāl, Udaipur, and other States of Central Ind

and Rājputāna; but in British territory the cultivation is mainly restricted to Bihār and the Districts of the United Provinces lying in the north of the Gangetic valley, where it is conducted on behalf of Government (see Vol. IV, chap. viii, Miscellaneous Revenue), to whose officers the growers are bound to deliver the whole produce. Advances are made by the Opium Department to meet the cost of cultivation, and the price to be paid for the produce is fixed at the same time.

The statistical returns give the average area under poppy for the ten years ending with 1899–1900 as 1,000 square miles. The area in the United Provinces is nearly 625 square miles, and in Bengal more than 310 square miles. The Punjab grows about 11 square miles.

Cultivation.

Poppy is a *rabi* crop, and in the United Provinces it is grown by preference on heavy loams or light clays. The season extends from October to March–April. The seed is sown somewhat later than ordinary *rabi* crops, and a watering before sowing may be necessary. The crop is expensive to grow, and is only remunerative if the cultivation is liberal as regards tillage and manuring. A fine degree of tilth and a firm seed-bed are necessary for the best results. The seed is broadcasted at the rate of 3 lb. per acre in October–November in beds which have been laid out for irrigation, and is lightly covered with a rake. The seedlings are delicate when young, and light irrigation is required before they are established. The plants should be thinned out till they are 8 or 10 inches apart. The crop requires repeated weedings, and the stirring of the surface soil is also beneficial. Top-dressing with crude nitre or nitre earth is a common practice. Growth is slow until February, and irrigation is required every two or three weeks. The crop is subject to many injuries, frost and hail being most dreaded. Cloudy days and east winds are also harmful.

Poppies are ready to yield opium when the capsules turn a light-brown colour and become somewhat hard. In order to collect the drug the capsules are scarified with a three-bladed instrument. Deep scratches are made in the capsule in the evenings, only one part of it being lanced at a time. The operation is repeated five to eight times at intervals of two days, and the work is very laborious. The morning after lancing a gummy juice is found exuding from the cuts. This is crude opium, which is collected and stored in earthen jars until the whole produce is obtained.

The ripe capsules yield an oilseed which is chiefly exported

to Europe. The oil is clear and limpid, and is used t adulterate olive oil. The oil-cake is a good cattle food. Th capsules are useful medicinally for poultices and fomentatio The petals as they fall to the ground are collected, and use subsequently for packing the opium.

The out-turn of crude opium is believed to average abou 20 lb. per acre; the crop may also yield 250 lb. of seed per acr

Exports. The bulk of the opium produced in India is exporte principally to China, where it is subject to increasing compet tion with the Chinese drug[1]. In 1896–7 the exports amounte to about 62,000 chests of 140 lb. each, valued at 8 crores. I 1903–4, a year of exceptional prosperity for the Indian dru owing to failure of the China crop, the exports were abou 73,600 chests, valued at $10\frac{1}{2}$ crores.

Pepper. Pepper is one of the oldest Indian exports, having bee conveyed to Europe from the Malabar coast from very ancie times. The plant (*Piper nigrum*) is found wild in the fores of Malabar and Travancore, and is extensively cultivated b native and European planters in the south of India. It is large vine-like climber, which clings closely by adventitiou roots to any support. The flowers are pendulous spikes, an each of the red berries is about the size of a pea, containin a soft stone covered with pulp. The plant thrives best in tropical climate, with moderate extremes of heat and cold an a rainfall of about 100 inches or more.

The spice gardens of Kanara. The spice gardens of Kanara are very successfully cultivate The owners are Haviks, a shrewd and hard-working class Brāhmans. Betel palms, cardamoms, and pepper are grow together. The gardens occupy the bottom lands of narro valleys above the Ghāts, whose slopes are fairly extensiv moderately steep, and covered with forest. The forest grow gives beneficial shelter, and supplies the gardens with brushwoo leaves, and litter for manure and other purposes. The narro garden strips follow the course of *nullahs* (ravines). In formin the gardens the beds of these *nullahs* are levelled. The hill slop on each side have been cut away to provide soil for levellin and now many of the gardens are bounded laterally by almo perpendicular cuttings 10 to 20 feet in height, which form barrier to trespass by men or beasts, and shelter the garde from storm and wind. Drainage is thoroughly carried out main ditches cut along the course of the garden strips, and minor cross drains. The soil is thus kept moist througho the year, but is at no time water-logged.

[1] See Vol. IV, chap. viii.

The most suitable soil is a yellowish-red or reddish-brown earth, which usually exists in deep beds. After the soil has been levelled and the drainage channels made, betel palms and cardamoms are put down in alternate rows, the palms being from 6 to 8 feet apart.

When the betel palms are about ten years old, pepper is planted, usually from cuttings, in leaf-mould manure placed at the root of each tree. The young vines grow rapidly and branch freely. They should be trained straight up the palm, to which they are secured by bands stripped from the sheaths of fallen palm leaves. Luxuriant growth and free branching are encouraged by heavy applications of manure, given annually for three years after planting. Subsequently a lighter dressing is given every second year. Cultivation.

The best manure for pepper and the other crops of the spice gardens is made from green leaves and twigs, plucked from certain forest trees in the monsoon, and used as litter in the byres where buffaloes and other cattle stand, and thence removed, with the dung and urine of the cattle, into deep pits. The manure is sufficiently decayed by the following April, when it is applied.

Pepper comes into bearing three or four years after it is planted. The plants in an established garden rise to a height of 15 to 20 feet, and the foliage of healthy plants is fairly dense. The flowers appear in July–August, and the berries are ripe by March. The yield depends upon liberality in manuring and careful management, also upon the rainfall. If the rains are very heavy when the plant is in flower, fertilization is interfered with. The vines on one palm when in full bearing yield in a good year about 1,000 clusters, from which about 4 lb. of dried pepper can be obtained.

The plants, the flowers, and the fruits are damaged by rough handling. Ladders are therefore used when binding the vines to the palms and when gathering the fruit. The bunches of berries are plucked by hand into a basket slung behind the workman, usually when the berries are changing colour. The berries may or may not be sorted as they are plucked. If they are sorted those fully ripe are separated, and are soaked in water for seven or eight days or heaped so that the pulp ferments. If the quantity is small, the fermented berries are rubbed by hand on a coarse cloth; if large, they are trampled under the feet of coolies. The pulp is thus rubbed off the 'stone,' which furnishes the white pepper of commerce. The pulp is completely removed by washing in baskets in running Disposal of the out-turn. White pepper.

water. The pepper is then dried in the sun for about a weel and becomes pale grey or pale drab in colour. It can b bleached a lighter colour by chemical agency. White peppe is prepared only to a limited extent in the Kanara forest.

Black pepper.

The chief product is black pepper, obtained from unsorte berries which are heaped up for four days. The green berrie then become softer and change colour, when they are sprea out and dried. The skin and part of the pulp adhere as a dr dark-coloured wrinkled covering to the stones, and the peppe is black in appearance.

In 1903-4 (a very good year) the value of the pepper ex ported from India was 51 lakhs.

Tea.

Tea (*Camellia theifera*) belongs to the same genus as th camellia, and is found wild in the Nāgā Hills and Manipu forming a feature of the prevailing forest growth.

History.

In 1788 Sir Joseph Bankes (then Director of the Roya Botanical Gardens, Kew) suggested to the Directors of th East India Company that efforts should be made to cultivat tea in India. Some few years previously Colonel Kyd, Supe intendent of the Royal Botanic Gardens, Calcutta, had actuall obtained seed from China and had grown the plant in Calcutta Little or nothing of a practical nature was, however, accom plished until 1834, when Lord William Bentinck appointed committee to investigate the question of establishing a tea growing industry. This committee was apparently ignoran that Mr. Robert Bruce in 1821, and Mr. Scott in 1824, ha discovered the tea plant in Assam; and much expense an considerable delay were accordingly incurred in sending ex peditions to China to procure tea seed, and to obtain Chiname to teach the people of India how to grow the plant and t manufacture tea. While one of the deputation was actually i China collecting seed, Captains Charlton and Jenkins re-dis covered the wild tea plant in Assam, and attention was thu fortunately directed to the indigenous stock.

In the early days of tea cultivation, especially in Assan many mistakes were made as to site, soil, cultivation, an manufacture, which caused disappointment and loss. Th real progress of tea-planting in Assam began about 1851, an was greatly assisted by the promulgation of the Waste-Lan Rules of 1854. In 1855 indigenous tea was discovered in th Cāchār District, and in the following year in Sylhet, and Eur pean capital was directed to these quarters. The tea industr was established at Darjeeling in 1856, and in Chittagong an Chotā Nāgpur about 1862. In 1859 there were fifty-one garder

in existence; and the extension and success of tea cultivation after this date engendered a wild spirit of speculation in tea companies both in India and at home which culminated in 1865–7 in great disaster, due to extravagant expenditure in cultivation and management and to incapable supervision. Many of even the best-situated gardens were sold much under the cost of establishing them, and the industry did not regain a stable position until 1869. Little interest was taken in tea cultivation in Southern India until about this period. In the early stages of the industry Government owned and worked tea gardens (especially in Kāngra, Kumaun, and Dehra Dūn); but by 1865 it had made over its plantations, on favourable terms, to natives and Europeans. The establishment of large plantations, and the utilization of machinery in place of manual labour, cheapened production. The freedom from the adulteration and impurity incidental to Asiatic hand-labour also tended to raise the appreciation of Indian tea in British markets, and thus enabled it to oust the produce of China.

About 1880 the coffee industry of Ceylon had been ruined through neglect to combat the destructive action of an insect pest and a fungus blight. Profiting by the experience and knowledge gained in India, the Ceylon planters abandoned coffee and took to tea, and to-day Ceylon is India's chief competitor in foreign markets. The United Kingdom takes between 88 and 90 per cent. of the Indian teas; and in 1902 this amounted to 54 per cent. of the total British imports, 36 per cent. having come from Ceylon and 6 per cent. from China.

Statistics.

The expansion of the Indian area of production may be illustrated by the following figures: in 1885, 440 square miles, which produced 71,000,000 lb.; in 1895, 650 square miles and 143,000,000 lb.; in 1900, 815 square miles and 197,000,000 lb.; and in 1903, 820 square miles and about 209,000,000 lb. The capital invested is probably not far short of £20,000,000. In 1903 the industry gave employment to 479,000 permanent and 93,000 temporary employés. The labourers, who have been taken to Assam in connexion with tea-planting, have materially assisted in the economic development of that Province. In 1876–7 the exports of tea were valued at 2·6 crores, in 1901–2 at 9·6 crores, and in 1903–4 at 8·6 crores.

New markets.

The production of tea in India and Ceylon has increased so much more rapidly than the consumption in the United Kingdom as to cause a heavy fall in prices within recent

years. Efforts are now being made to open up new markets the more promising of which appear to be Russia, Canada, and the United States. In 1903 a trifling duty was imposed, at the request of the tea industry, on exports by sea, and the proceeds are applied, by a representative committee, to increasing the consumption and sale of Indian tea. There is a growing export of Indian tea by land into neighbouring countries, chiefly on the north-western frontier: it amounted to nearly 2,000,000 lb. in 1903–4. The townspeople of India are adopting the tea-drinking habit to an increasing extent. In 1901–2 about 7,000,000 lb. were retained in India.

Areas of production.

Of the 820 square miles under cultivation with tea in 1903–4, 530 square miles were in Assam, and 210 square miles in Bengal, while Madras, the Punjab, and the United Provinces followed, with areas ranging from 19 to 13 square miles. The chief tea-growing Districts outside Assam are Darjeeling, Jalpaiguri, the Nilgiris, Kāngra, and Dehra Dūn.

Races of the tea plant.

Five distinct races of wild tea are now recognizable, if the China plant may count as one: namely, the China, Assam indigenous, Manipur or Burma, Nāgā, and Cāchār or Lushai indigenous types. The last is essentially a bush, while the plant of each of the other races is a small tree or a narrow bush, usually less than 5 feet in height, with ascending branches which take off near the ground.

These forms, and especially the first two, have influenced the character of the cultivated plants, particularly in Assam. Natural cross-fertilization between the China and other races has freely occurred. The China plant is popularly believed to have had, at least in the plains, a degrading effect, and most planters would like to get rid of it and its numerous crosses. But under certain circumstances a good hybrid may be more profitable than the purest and best 'Assam indigenous.' It flushes earlier and is less affected by deficient rainfall.

The garden plant.

In the hands of the planter the characters of the tea plant have been materially changed since cultivation began in India. Experience has taught him how to improve its flushing power. The China plant is usually low branched, and has rarely a distinct stem. Hybrids and indigenous kinds are pruned into bushes 4 to 5 feet high, with short fairly thick stems. Watt and Mann (*Pests and Blights of the Tea Plant*) write regarding the garden plant: 'It has to a large extent been deprived of the power of flowering and fruiting. Its whole energies have been concentrated in the flushing or production, during part of the season at least, of complete new sets of shoots which each

bear a terminal bud, and three to seven leaves according to the system of plucking that may be pursued.'

Tea is cultivated in India from a few hundred feet above sea-level to an altitude of about 7,000 feet. Formerly the theory was held that tea grew best on elevated situations, and that the slopes of low hills or *tīlas* were specially suitable. But tea planted on such land in Cāchār and Sylhet has been abandoned in favour of the lower flat *bhīl* lands, which were swamps at the commencement of the tea industry in these Districts. *Tīlas* were originally covered with dense forest, and were fertile when cleared, but under tea cultivation they deteriorated by the wash from heavy rain. This erosion was really induced by bad agriculture. Attempts have been made with some success to prevent erosion by terracing the slopes of these hills, but often this was only done when the best of the soil had been washed away. The districts in which tea is successfully cultivated in North-east India have a rainfall varying from 60 to 200 inches. The gardens chiefly occupy alluvial land which is flat or rolling. During the growing period a moist warm atmosphere is desirable and hot dry winds are injurious. A rainfall of 100 inches is fully sufficient, provided it be well distributed. Situation of tea gardens.

The tea plant will grow on many kinds of soil; but those which give the best returns in quantity and quality are the deep reddish-coloured sandy loams, with a free subsoil, which allows the roots of the plants to penetrate and secures natural drainage. The *bhīl* soils, which when first opened up and drained contain an excess of organic matter, give a very vigorous growth but, as a rule, weak flavourless tea. The quality, however, improves after a few years of cultivation. It is useless to plant out tea on inferior land, as the yield will be poor, and the plants are almost certain to become blighted at an early age. Two descriptions of soil are especially to be avoided—a stiff clay of any kind, which is impervious to rain and which cakes and hardens in the sun; and a very loose sand which generally overlies gravel. Such soils produce a stunted bush yielding little leaf. Recent researches by Dr. Mann, the expert of the Indian Tea Association, show strong reason for believing that the good quality of tea obtained from soils other than *bhīl* land is primarily due to the amount of phosphoric acid and potash present. Soils.

The processes of preparing and working tea gardens in Assam are as follows. In bringing new land into condition the jungle should be cut down in December and burnt in Preparation of gardens and nurseries.

February. It should then be well dug, cleared of weeds, levelled or terraced where desirable, and if necessary drained. When thoroughly cleared the land should be marked out for seedlings by stakes. The usual distance between plants is from 4 to 5 feet. On the poorer kinds of *tila* and upland soil the plants should be closer than on good low-lying land. The site of the nursery should be near a water-supply, in a low-lying position, protected from the sun and high winds. Artificial shade is usually required, and the surface should slope slightly so that excessive rain will drain off. The soil should be a good deep loam with a porous subsoil. It should be carefully dug, pulverized, weeded, and laid out into beds 3 or 4 feet wide. The seed is allowed to germinate before sowing, by keeping it under moist grass. The sowing takes place in December–January, and the young seedlings are placed 4 or 6 inches apart in the seed-beds. Planting-out takes place in the cold weather (about February) and during cloudy days if possible in the case of plants a year old, or just before the monsoon in May, or early in June at the latest, if young seedlings are used. Each seedling is removed from the seed-bed with a clod of earth, so that the root and rootlets may remain uninjured, and a hole of ample size is dug for its reception. Special care is required in planting and keeping the land clean during the first season.

Sowing and planting.

Weeding and pruning.

For the first two years the chief work of the planter is to keep the young shrubs clear of weeds. Weeding and tillage are done by hand, chiefly with a hoe or fork. Pruning is essential, to give each bush a particular height and shape, to remove injured or diseased portions, and to encourage the greatest possible surface for branch and leaf growth. The following description is of fairly general application. When the plants have been in the ground eighteen months if planted at six months old, or a year if planted after twelve months in the nursery, they are cut down to 8 or 10 inches at least. This operation makes the bush spread, and in three or four months a number of new branches will be produced. Every shoot is nipped back to about 20 or 24 inches from the ground. Nothing is taken from the bushes below this level, but above it two leaves and a bud may be plucked wherever they occur. At the end of the season the bush is pruned again about 20 inches from the ground, and each year thereafter one or two inches above the previous year's cutting until the growth ceases to be vigorous. The bush is then cut back to 15 or 18 inches from the ground. The pruning is done with a sharp

knife, and it is a good plan to bury the prunings between the rows of tea bushes. Pruning takes place in the cold season from December to February: China plants are first attended to, then hybrids, and finally the indigenous kinds.

It is not customary to apply manure to the better descriptions of tea soils; but the need of manure for the upland gardens which have been long under cultivation is now recognized, and local supplies have been exploited and used. Top-dressing with *bhīl* soils, forest surface earths, and other earths comparatively rich in manurial elements, has been practised profitably; and green manuring with *matikalai* (*Phaseolus aconitifolius* or *P. Mungo*) is now not uncommon. Castor cake, mustard cake, bones, and cattle manure have also been used with good effect: cattle manure could be collected locally and used in much greater quantity than at present. Tea removes less from the soil than most crops; but, unless manuring becomes more general than at present, exhaustion of even the best tea soil must in time occur. Manuring.

The tillage given in any particular garden is regulated more by the amount of labour available than by the requirements of the crop. On sloping upland gardens which are not terraced it is necessary to limit the period of tillage, for if the surface soil is loose at any period during the rains the erosion down the slopes is enormous. Such limitation does not, however, tend to productiveness in the plant, and all tea gardens occupying slopes should therefore be terraced. In the early part of the cold weather the soil is hoed to a depth of 8 or 9 inches, to bury the weeds, which grow up during the heavy rains. Repeated light hoeings between March and July are also necessary. A certain amount of hand-weeding is required on all descriptions of soil during the rains, to clear away vegetation interfering with the free access of air. Tillage.

Each tea plantation of any importance should have its own seed garden isolated from the leaf garden, but within easy distance for close supervision. The plants in it should be true to their kind and suited to local conditions. Different districts require different races, and uniformity in the plants of a garden is essential for remunerative cultivation. The selection of seed and the improvement of varieties in seed gardens are also of great importance. Plants which are intended to produce well-developed seed require radically different treatment in pruning and general cultivation from the leaf plants. Seed-selection.

Regular plucking begins when the plants are three years old. They may, however, be lightly plucked in the second year to Plucking.

give the bush a defined shape. Even in the third year, plucking should still be considered a method of pruning. In the earl days of tea-planting the bushes in Assam yielded only fou 'flushes' annually. Now the average is about twelve, an a still larger number is obtained from plants in full vigour Some planters pluck for quality, others for quantity; bu experience shows that heavy plucking early in the season is very detrimental, particularly to young bushes. The earl spring shoots are allowed to grow until they have about seve leaves. Then the two or three youngest leaves and th terminal bud are nipped off by finger and thumb. Flushe follow pluckings throughout the season. The pluckers g round the garden every ten days or so and gather all that is ready.

Manufacture. Withering.

The first process of manufacture is withering. On most estates this is now done artificially, by dry heated air which is drawn over the leaf by means of large revolving fans. The amount of moisture that evaporates depends chiefly upon the natural succulence of the leaf, as whether it is wet from rain. Ordinary leaf which is not wet loses about 33 per cent.

Rolling.

The object of withering is to get the leaf into suitable condition for rolling, which is the next process. Rolling was till lately done by hand, as it still is in China, but machines are now used. The object of rolling is to twist the leaves and break up their cellular structure so that the juices escape. The leaves are machine-rolled for about twenty minutes, and are then passed into a revolving screen which separates the coarser leaves and stalks from the fine. The coarser leaves are again rolled for ten minutes.

Oxidation.

The next process is oxidation, which is carried out in a separate cool room, with the atmosphere kept moist by sprinkling cold water. The appearance and quality of manufactured tea greatly depend upon oxidation being properly regulated. The leaf is spread out on a cement floor in a layer four or five inches thick, and turned if necessary to prevent the temperature rising too high. The most favourable temperature is about 85°. The younger leaves and stems gradually assume a bright coppery colour, while the older leaves are partly reddish and partly green.

Drying, sifting, and packing.

The leaf is now ready for a second rolling before drying Oxidation is checked by exposing the wet leaf to the action o dry air, which is heated above the boiling-point of water, so a to remove all moisture without driving off any of the constituents which add to the flavour and value of tea. Drying

is done in two or three stages, several kinds of machines being used for the purpose. Then follow the sorting and sifting, which are effected partly by machinery or entirely by hand. The latter is best, as the tea can thus be more accurately sorted into the different qualities or grades. The tea as it is sorted absorbs moisture from the air and is again heated before it is packed. It is then packed while warm, but not hot, in the well-known lead-lined tea chests.

Coffee. History and production.

The coffee plant (*Coffea arabica*) is believed to be a native of Abyssinia, and most writers agree that it was brought to India (Mysore) about two centuries ago by one Bābā Budan who had made the pilgrimage to Mecca. Linschoten, who travelled in Southern India between 1576 and 1590, makes no mention of having seen it, while Tavernier, who went over very nearly the same ground in 1665–1669, gives a full account of the coffee plantations that he visited. Coffee cultivation was attempted in the suburbs of Calcutta at the beginning of the nineteenth century, and some plants may still be seen on the site of the original plantation. The industry, which began to be developed on a large scale about 1860, has been a success only in Mysore, Coorg, Travancore, the Wynaad, and the Nīlgiri and Shevaroy Hills of Madras; and it has made no progress during recent years. In 1896 the area under the crop was 450 square miles; and in 1903, only 320 square miles, of which 250 square miles were in Mysore and Coorg and 56 square miles in Madras. In 1903 about 82,000 persons were employed in the plantations, and there were eighteen coffee works, giving employment to 5,000 persons. The exports in 1903–4 were 291,000 cwt., valued at 137 lakhs. The large supplies of cheap Brazilian coffees that now flood the markets of Europe have injured the coffee industry of India very seriously, since they have caused prices to fall by one-half.

The plant

The coffee plant is a much-branched small tree or bush which, if left to grow naturally, is 15 to 20 feet high, and bears white orange-like flowers. The fruit turns red as it ripens and resembles a small oblong cherry: it contains two seeds, closely united. There are several varieties of coffee, but that most commonly cultivated in India is *C. arabica*. Liberian coffee is grown, but not extensively.

Cultivation.

Coffee grows best at altitudes between 2,000 and 5,000 feet, with a rainfall of 70 to 90 inches and a temperate climate. Sloping or even fairly steep land is suitable, provided that surface erosion is prevented. Good natural drainage is important, and flat and wet lands are unsuitable. The soil

should be of fair depth, retentive of moisture but not st in consistence. Newly cleared forest land with these chara teristics, being rich in organic matter, is very suitable for coffe

Seed-beds.

Perfectly ripe seed is collected for sowing, from healthy an vigorous plants which are from seven to ten years old. Th seeds retain their germinating power for only a short tim February is the best month for sowing. It is not necessar to put coffee seed in the ground to make it germinate properl In the Nilgiris the seed is laid thickly on the surface (a seed-bed, with a covering of ferns or old gunny bags. I kept moist, the seed germinates, and when the germ is ha an inch to an inch long the seed is planted in nurserie The site of a nursery should be near water, in a well-sheltere and naturally drained situation, with good and fairly leve soil. The shade of trees, if not too dense, is beneficial The seed-beds should not be more than 5 feet wide, anc should be higher than the pathways between them, and b thoroughly dug and tilled before sowing. The germinatec seeds are planted 4 inches apart. Regular watering is required either in the morning or after sunset. The seedlings are transplanted into other seed-beds when they have two to four leaves, and are there placed 9 to 12 inches apart. Trans plantation is most successful if done when the weather is damp and cloudy. When the seedlings are about one year old they are ready for planting in the permanent plantations.

Plantations.

A coffee plantation is usually established in a forest clearing The jungle is cleared in December, and the trees burnt, when dry, in February. Some of the larger trees are, however, lef to give shelter and shade. The clearing is completed by digging and levelling, and by burning roots and spreading the ashes. Pits are dug about two feet deep, the excavatec earth being pulverized and partly returned to each pit before the seedling is planted. The space allowed between coffee plants depends upon the character of the soil, and varie from 6 to 8 feet in each direction. If necessary, quick-growing subsoil-feeding trees are specially planted for shade.

Weeding and hoeing.

Hand-weeding is commenced as soon as the land is cleared A light hoeing is also required once a month until the plant are fairly established. Hoeing and weeding cost from 12 anna to 1 rupee per acre per month in the first year. Forkin or deep hoeing once a year is beneficial to open up th hardened soil. The soil is dug to a depth of 12 inches. I localities where strong winds are common the young plant require support.

Coffee is an exhausting crop, and when in full bearing requires manure regularly, but none is necessary until the first crop has been gathered. Weeds, prunings, the fallen leaves of shade trees, and other vegetable matter which has rotted on the surface between the trees provide a good deal of useful manure. Forest top-soil is available on some estates in considerable quantities; but the planters have usually to depend chiefly upon well-rotted cattle manure, bone-meal, and oil-cake. Two applications of manure may be given in a year, the first immediately after the crop is gathered, the second after the heavy monsoon rain. Manures.

The plants should be 'topped' when $4\frac{1}{2}$ to 5 feet high by nipping off the central bud. The principal objects of topping are to secure the plants against wind and storm, and to make it easier to collect the crop. Topping checks a too free upward growth, and causes the plants to branch freely. Secondary branches spring from the primaries in pairs: all such appearing within 6 inches of the main stem should be removed, a passage being thus left in the centre of each tree for free admission of air. The object of pruning is to divert the energies of the plant from forming wood, and to concentrate them upon forming fruit. The primary branches are cut back at $2\frac{1}{2}$ feet from the stem. Secondary branches are cut away after they fruit, but one of each pair of laterals is left every year, to ensure a continuous crop. Topping and pruning.

The plants come into bloom in March, when they have been planted for two or three years, and annually thereafter. Good trees will yield a first crop in two years; but this is left ungathered, the berries being stripped off before they develop. If a maiden crop from three-year-old trees is a heavy one it is thinned, otherwise there will be little crop in the following year. Full crops may be taken in the fourth year from planting, and thereafter. The fruits commence to ripen in October or early in November, and continue till January. Women and children are sent over the plantations periodically to gather all the blood-red berries. When the whole crop has been gathered, the boughs are tied up, so that fallen berries may be conveniently collected, and manure and tillage applied. Plucking.

The ripe coffee fruit is termed the cherry; the succulent outer coat of the fruit, the pulp; the inner adhesive layer, the parchment; and the seed coat within the parchment which adheres closely to the seed, the silver skin. The preparation of the coffee bean from the cherry is accomplished in the following Manufacture.

stages: pulping, fermenting, drying, peeling, milling or hullii and sizing or winnowing.

Pulping is done daily as the crop is gathered. The pulp c be removed from the bean by hand or by machinery. T beans are then fermented to remove a sticky mucilaginous su stance. The produce gathered in a day is put into a vat, a is left for 24 to 36 hours until fermentation sets in. T fermented beans are washed into a second vat by a stream water, and are there thoroughly cleaned. The washed bea are then carried by flow of water to the drying floors, a exposed to the influence of sun and air. During the dryi the beans are turned over repeatedly. Peeling means t removal of the parchment and silver skin from the bea by pounding or by machinery. The parchment coffee is w warmed in the sun before it is peeled, and the peeling is n undertaken on a wet or damp day. Winnowing is perform by hand with the ordinary *sūp*, or by machine-fanning, whi drives off the parchment and the skin, leaving the clean coff beans behind. The beans when thoroughly dry are packed casks.

Out-turn. The average yield from mature plants is from 300 to 400 l of clean coffee per acre. Prices vary according to the si colour, smell, flavour, and uniformity of the coffee beans.

Cinchona. History and production. Government cinchona plantations were started in India 1862 from seed introduced by Sir Clements Markham fro South America, of which the plant is a native. There a two main centres, Darjeeling and the Nīlgiri Hills. In bo localities a portion of the area is owned by tea or coff planters, and the bark they produce is either sold to t Government or exported. In Darjeeling there is only o private cinchona plantation; in Madras there are about thir Several species of cinchona are cultivated in India: name *Cinchona succirubra* (red bark), *C. calisaya* and *ledgeriana* (yell bark), and *C. officinalis* (crown bark). The commonest spec in Darjeeling is *C. ledgeriana*, and in Southern Inc *C. officinalis*. A hybrid form is also largely grown and yiel a good bark. The area under cinchona appears to be c creasing: it was about 12½ square miles in 1896-7, and l than 8 square miles in 1903-4, about two-thirds being in t Nīlgiris. Attempts have been made to introduce cinchona ir the Mahābaleshwar hills (Bombay), the Khāsi Hills, and t United Provinces, but have failed owing to unfavoural climatic conditions. At the Government factories both c chona febrifuge and quinine are made. The production

1901–2 was 14,000 lb. in the Madras factory and nearly the same amount in Bengal. Thanks to these factories, practically no quinine is nowadays imported for Government purposes. Private imports of quinine by the trade were in 1903–4 valued at six lakhs. The exports of bark have ranged, during the past five years, between 1·1 and 3 million lb.

Varieties and soils.

Quinine-yielding cinchonas do best in a cool climate in which the difference between summer and winter, and between day and night temperatures, is not very great. *C. succirubra* succeeds at altitudes from 3,000 to 6,000 feet, and *C. officinalis* at from 6,000 to 8,000 feet. A rainfall of 50 to 100 inches is required. Cinchona grows well on newly cleared forest areas, with rich soil, an open subsoil, a sloping exposure, and other conditions of perfect drainage. Flat land is unsuitable; but some species, such as 'crown' or 'pale' barks, grow fairly well on grass lands.

Seed-beds and nurseries.

The cinchona seed germinates best at a moderate temperature, and can be successfully sown in the hot weather or the rains. Seedlings are raised in seed-beds, sheltered by thatched roofs and otherwise during storms of wind and rain. The seed-beds are made on cleared ground, with a mixture of sand and fine rich vegetable mould, collected in the forest and spread two or three inches in depth on the selected site. They extend east and west, and are carefully drained, but must not have an excessive slope. The seed is sown thickly, and covered with fine earth lightly pressed down. It takes from two to six weeks to germinate, according to temperature, and during this time the seed-beds require light watering daily. When the seedlings have two or three pairs of leaves, they are transplanted into nurseries, the soil of which has been well dug, cleared of roots and stones, and thoroughly pulverized. Here they are planted about 2 inches apart in each direction. The seedlings are transplanted a second time when 4 or 5 inches high and placed farther apart. When the seedlings get fairly rooted the thatched protection is removed. The object of these various transplantations is to harden the seedlings and encourage root development, so that they can be successfully transplanted into the permanent plantations when 9 to 12 inches in height. From eight to twelve months elapse between the first sowing of seed and the final plantation.

Permanent plantation.

The land selected for a cinchona plantation is cleared of its natural vegetation, which, when dry, is burnt on it. After clearing, the sites in which the plants are to be put are marked by stakes. A pit is dug at each stake, usually measuring

18 inches in each direction. The earth excavated is broken up, and replaced by scraping in the surface mould. In this free mass the plants when planted take root readily.

Planting should be done when the weather is cloudy, or even wet, but heavy rain is not favourable. The distance between plants is usually 4 feet or less. The cost of close planting is considerable, but the advantages are great, for the soil is protected from sun, the trees produce clean straight stems, and the growth of weeds is checked by shade.

In certain localities young plants require special protection from the sun, which is afforded by planting ferns or erecting a rough framework of bamboo on the sunny side of each plant, to which the grass or leaves of any tree can be tied.

Weeding and pruning.

For the first three years two or three weedings or hoeings are necessary, and subsequent high cultivation improves the growth of the tree and the alkaloidal contents of the bark. The weeds are cut close to the ground and left to rot and serve as a manure.

As the trees become crowded by growth, pruning of the lower branches is required to admit free circulation of air ; and later it becomes necessary to thin the plantation.

Methods of harvesting.

The age of the trees when bark may be first gathered varies with the species and altitude. It may be six years in the case of *C. succirubra* at the lower elevations, and ten to fifteen years for *C. officinalis* at higher altitudes. There are three processes of harvesting: mossing, coppicing, and uprooting. In 1863 Mr. McIvor, in dealing with the Nilgiri trees, discovered that the cinchona tree has the power of renewing its bark if the space from which the latter is taken is immediately covered with damp moss. The mossing system failed in Darjeeling owing to the attacks of ants, and is being abandoned in Southern India as it hinders the development of the trees.

The commonest system practised in Southern India is coppicing. The trees are cut down close to the ground, and the shoots rising from the stumps are allowed to grow. Harvesting by uprooting trees has some advantages, but it is now held that coppicing is the safest method, if trees are not too old. It can be repeated several times.

Time and mode of harvesting bark crop.

The best season for taking the crop is the cold weather. The bark is first marked off into long narrow strips with longitudinal and transverse incisions ; one end of the strip is then raised by the knife and the rest is easily freed by pulling. The bark thus taken off is dried in rough sheds, fitted up with open shelves made of split bamboo. It is then carried to the drying

house, which is a masonry building fitted up with shelves and arrangements for charcoal fires, where the bark is thoroughly dried at a temperature of about 100°, so as not to affect its chemical composition.

The method of manufacture in Northern India is as follows:— The bark is first reduced to a very fine powder in disintegrators. It is then treated with a mixture of shale oil and solution of caustic soda in large iron vats kept at a suitable temperature. After being stirred till all the alkaloids have been taken up by the oil, the contents of the vats are allowed to settle and the oily layer is run off into a tank where it is heated. The alkaloids are then separated by mixing with dilute sulphuric acid, and the oil can be used again. The acid solution is again heated, and then neutralized with a solution of caustic soda, after which it is cooled in lead-lined troughs, where crude sulphate of quinine crystallizes out. Further processes of solution and precipitation are applied to the crystals, after which the pure sulphate of quinine is dried and sifted and is ready for use. Cinchona febrifuge is prepared from the mother liquor in which crystals are first formed, by decolorizing the liquor and then adding caustic soda, which causes a precipitate to form. The latter is washed and dried, and constitutes the febrifuge. Manufacture.

The medicinal alkaloids contained in cinchona bark are quinine, cinchonidine, quinidine, and cinchonine. Arecine is also occasionally found.

The Nīlgiri plantations yield bark of two kinds, red and crown. Red bark is rich in the total quantity of alkaloids, but gives a poor quinine. It is valued in Europe by druggists, as being very useful for decoctions. Crown and yellow barks are rich in quinine and therefore highly valued by quinine makers. The medicinal properties of cinchona bark have been carefully tested, and the general opinion is that the other alkaloids it contains are as efficacious in curing fevers as quinine itself. Hence the red cinchona bark is useful as a cheap febrifuge. Qualities of cinchona barks.

The indigo dye was known to the Greeks and Romans (indigo is the Greek *indikon*); but very little is said of it in the ancient writings of India, and even in the *Ain-i-Akbarī* it is only alluded to incidentally as procurable in Agra. Most of the early European travellers, down to Dr. Hove in 1787, speak of indigo as cultivated in Western and Southern India; and there is abundant evidence that, when European traders first began to purchase and export the dye, it was procured in Western India and shipped from Surat. It Indigo. History of production in India.

was carried by the Portuguese to Lisbon and sold by them to the dyers of Holland, but these soon procured their supplies through the Dutch East India Company. The success of the Dutch merchants aroused the jealousy of Europe. The woad growers and merchants of Germany, France, and England were threatened with ruin, and to protect them nearly every country passed edicts rendering the importation or use of indigo an offence severely punishable. In the reign of Queen Elizabeth the use of indigo was permitted along with woad; but the opposition to it was so strong that it was again prohibited on the pretext of being poisonous, and in 1660 Charles II had to procure dyers from Belgium to re-teach the English the art of using the dye.

When the English East India Company began to export indigo from Surat direct to England, the trade flourished so much that the European colonists in America took to growing and manufacturing the dye. The improvements they effected were so great that the Indian article was no longer desired, and its cultivation was discontinued in Gujarāt and never resumed in that part of the country. In time, however, the American colonists found that sugar and coffee were likely to pay better than indigo, and an impetus was thus given to a revival of the Indian production. The experiments organized with that object by the East India Company were made in Bengal. For a time production was a monopoly of the Company; but as its servants were free to trade, many took to cultivation on their own account, and were so successful that they obtained permission to resign the Company's service and became indigo planters. For some years the produce of their factories was compulsorily sold to the Company and used for the purpose of home remittances. But in time even this restriction was withdrawn, and indigo became a perfectly independent and self-supporting European industry, the pioneer planting industry of India. Troubles next arose in Bengal between the planters and their cultivators, until legislation to protect the latter became imperative (1859). This led to another migration of the industry from Lower Bengal to Bihār and the United Provinces. But the troubles of the industry did not end here, for the researches of chemists have for years threatened the very existence of any natural vegetable dye. Their products have killed the madder dye of Europe; as also the safflower, the lac-dye, and the *āl* (*Morinda tinctoria*) of India; and synthetic indigo is now replacing the natural dye.

Varieties.

Various forms of *Indigofera* (at least forty varieties) are

found cultivated and wild throughout India, though many of the so-called wild indigos are escapes from former cultivation. In 1892 Major Prain, I.M.S., pointed out that the chief cultivated form in Bengal was not *I. tinctoria*, as had been supposed, but *I. sumatrana*, which was introduced about 150 years ago. This is also the principal cultivated form in Madras and the United Provinces. For many years no system of seed-selection has been practised; and there is little doubt that the plant commonly cultivated does not now produce a satisfactory amount of dye matter, particularly on worn-out indigo lands.

Within recent years Natal indigo (*I. arrecta*) has been introduced into India. The seed was obtained direct from Natal, and also from plants acclimatized in Java. Guatemala indigo (*I. oligosmera*) acclimatized in Java has also been introduced. The Natal and Guatemala plants are more vigorous in growth than those commonly grown in India, and have been proved to yield a much higher proportion of dye from a given weight of plant. *I. longiracemosa* has recently been rediscovered in Travancore. It is supposed to be one of the most valuable indigo-producing plants in the world.

The statistical returns show for British India an average area for the ten years ending 1899–1900 of 2,000 square miles under indigo, which in 1903–4 had declined to 1,100 square miles. The crop is most important in Bengal (Bihār), Madras, and the United Provinces, and is also grown to some extent in the Punjab. In Bengal, as already stated, the crop was largely raised by British planters, but this community has now considerably declined in number and importance. In Madras, the United Provinces, and the Punjab, indigo is chiefly grown by native cultivators. Areas of production.

In Bengal the industry has been greatly helped since 1897 by research work instituted by associations of planters, with assistance from Government. Excellent work in the chemistry, bacteriology, and agriculture of indigo has been done, and is still progressing.

The soils on which indigo is successfully grown are very varied in actual character and composition, but deep alluvial loams seem to suit the crop best. Many soils of this description in Bihār which grow indigo are deficient in phosphoric acid and nitrogen, but are generally rich in all other useful constituents. An average crop of indigo removes about 40 lb. of nitrogen and 120 lb. of mineral matter per acre. Soils and manures.

Extensive experiments in Bihār have proved that, in soils

deficient in phosphoric acid and nitrogen, superphosphate and nitrate of potash (a local product) can be economically applied. The refuse indigo plant (*sīth*) is the manure most easily obtained, and is very valuable; but it is less suited for indigo itself than for rotation crops such as sugar-cane, tobacco, poppy, cereals, and oilseeds. *Sīth* produces heavy crops of indigo, but the leaf is deficient in colouring matter. Oil-cake manures give somewhat similar results. Indigo grown on land heavily treated with *sīth* is, moreover, liable to injury from insect pests.

Seed.

There is a general belief among planters in Bihār that the best seed is obtainable from the United Provinces, and that local seed does not keep good from season to season and fails to germinate properly. The system of getting seed in this way, without any special selection, has caused deterioration in the varieties commonly grown.

Cultivation.

Cultivation begins as soon as the previous *kharīf* crop has been removed. Indigo may follow indigo, but is more generally alternated with the crops already mentioned. It is of great importance that the soil should retain the moisture that is supplied by the October–November rainfall. The land is well worked with the plough after being manured, and, when brought to a good state of tilth, is levelled and smoothed with the plank roller referred to on page 14. Indigo is sown in Bihār, and in the United Provinces where canal water is available, as soon as the nights begin to get warm, at the beginning of the hot weather. Elsewhere, it is sown at the beginning of the rains. In Bihār a special drill is used for sowing, with coulters about 5 or 6 inches apart. From 16 to 20 lb. of seed are required per acre. The seed should be sown as shallow as possible, but must be deposited in the moisture layer. The roller is again used to level the surface after sowing. The seedlings are very delicate until their roots get well developed, and many perish owing to dry west winds. Moist east winds after sowing, and spring showers later, are very beneficial. Several weedings are generally necessary. The plants make slow progress until the monsoon sets in, when the growth becomes very rapid. The plant should be cut when in flower. The first crop is ready in July–August, and ordinarily yields 80 to 120 maunds of green plant per acre. A second crop, obtainable in September, usually yields less. It is reckoned that 100 maunds of good ordinary plant should yield about 10 seers (20 lb.) of indigo.

Colouring matter in the plant.

The colouring matter from which indigotin is derived exists almost entirely in the leaf. The proportion of leaf is variable,

but good plants should give about 40 per cent. of leaves. A plant which is forced by manure to very active growth gives a poor percentage of dye matter. The amount of colouring matter in the leaf increases as the plant grows, but deteriorates after a certain stage, and harvesting and steeping should therefore be carried on expeditiously. Plants which have been cut some time and become blackened by heating in bulk contain very little dye matter, so the green plant should not be carted very far. The principal indigo concerns in Bihār have small out-factories. The plant gives less dye in wet weather, owing to causes which have not been definitely ascertained.

Under the old system of treating the plant two sets of vats were used, one on a lower level than the other; but with improved methods of fermentation, oxidation, &c., three sets may be required. The vats on the highest level are used for steeping, and are each about 1,000 cubic feet in capacity. Every 100 maunds of plant require about 4,500 gallons of water. The plant is kept submerged by logs of wood, or bars fixed in position. The period of steeping varies with the temperature of the air and water: if the temperature of the water is 90° to 92° F., twelve hours is sufficient. Instead of varying the time it is, however, preferable to heat the water in the reservoir to a definite temperature. Experiments in Bihār have proved that, when the plant is steeped in water at 150° to 160° F., the colouring principle is extracted in half an hour. Indigo made in this way is superior in quality and contains about 25 per cent. of indigotin. Active fermentation through the action of soluble ferments (enzymes) takes place during steeping, and causes the formation of a compound which is easily convertible into indigotin by the action of air. The water used in steeping should be free from organic matter, and should not be hard. These faults can be corrected by the addition of lime and potassium permanganate.

Factory processes.

Steeping.

When fermentation is complete, the liquid in the steeping vats, which now varies in colour from bright orange to olive green, is drained off into the oxidizing vats. Oxidation was at one time accomplished by hand-beating, but in most Bihār factories it is now done by a beating wheel worked by power from a central engine. If there is any delay in oxidation, a considerable loss of colouring matter results, and the indigo produced is inferior. As the oxidation proceeds, dark-blue particles of indigotin appear in the liquid, the colour of which consequently changes. The beating should be continued until a little of the liquid placed in a saucer readily throws

Oxidation or beating process.

down a dark-blue precipitate, itself remaining of a clear amber colour.

Lime and ammonia processes.

Coventry's lime and acid process (patented in 1894, and again, with improvements, in 1901) is used to a considerable extent in Bihār. This requires a vat intermediate between the steeping and beating vat, when lime is added to the indigo liquor. A precipitate of calcium and magnesium carbonates then forms, which also carries down various other impurities. The cleared liquor when run off into a lower vat and oxidized yields indigo of good quality, and a substantial increase of colouring matter is obtained. An ammonia gas process patented by Mr. Rawson in 1901 produces a direct increase of colouring matter.

Cooking.

The precipitate which settles after oxidation is known as *māl*. This is boiled, and the indigo produced from it is improved if sulphuric acid be added.

Final preparation.

The dye matter is then placed on a cloth strainer until it becomes fairly dry, when it is carried to the press and subjected to gradually increasing pressure until it has taken the form of firm slabs, which are cut into cakes and slowly dried on racks.

In Southern India, indigo is produced by what is known as the 'dry' process. The plants are dried in the sun, and the leaves threshed out and stored. In course of time they change colour from green to blue grey, and they are then macerated in water, and the dye is extracted, in much the same fashion as in the process above described.

Good indigo should contain 60 per cent. or more of indigotin. It should be bright and of a dark-blue colour, with a coppery gloss, and should break with an evenly coloured fracture.

Trade.

Excluding mere vats, which are numerous in Madras, the number of indigo factories was returned at 923 employing 173,000 persons in 1901, and at 531 employing 82,000 persons in 1903. These facts afford further evidence of the serious decline of the indigo industry, the total destruction of which would deprive 250,000 people of their occupation for part of the year.

The bulk of the factory-made indigo is exported, India consuming only the most inferior grades of the dye. Thus the returns of foreign trade nearly express the total production. Taking the figures in round numbers, it may be stated that the exports in 1876–7 were 100,000 cwt. valued at 3 crores; in 1886–7, 138,000 cwt. valued at 3·7 crores; in 1896–7, 170,000 cwt. valued at $4\frac{1}{3}$ crores; and in 1903–4 only 60,000 cwt

valued at little more than a crore. During the past few years the finer and expensive Bengal indigos have felt the depression of trade more acutely than the cheaper qualities of Madras. In 1896–7 Bengal exported 109,000 cwt. and Madras 44,000 cwt.; in 1903–4 the figures were 30,000 and 24,000 cwt. respectively.

Many sorts of vegetables are cultivated everywhere as garden crops for household use and for sale in towns. Garden cultivation is mostly carried on by special castes under a system of intensive cultivation. English vegetables are largely grown near large cities, and the native gardeners have attained a high degree of excellence in their production. The utilization of town sweepings and sewage has developed in many towns. The chief vegetables are the cabbage and its many varieties, turnip, radish, and the horse-radish tree (*Moringa pterygosperma*). Of pulses and beans the principal are the cluster bean (*Cyamopsis psoralioides*), sword bean (*Canavalia ensiformis*), duffin bean (*Phaseolus lunatus*), kidney bean (*P. vulgaris*), yam bean (*Pachyrhizus angulatus*), Indian bean (*Dolichos Lablab*), pea, cowpea (*Vigna Catiang*), and *Psophocarpus tetragonolobus*. The gourd and cucumber family is very numerous, including the snake gourd (*Trichosanthes anguina*), bottle gourd (*Lagenaria vulgaris*), towel gourd (*Luffa aegyptiaca* and *L. acutangula*), *tumba* (*Benincasa cerifera*), *karela* (*Momordica Charantia*), cucumbers (*Cucumis sativus*, *Citrullus sativus*, *C. vulgaris*, and *C. vulgaris* var. *fistulosus*), and pumpkins (*Cucurbita Pepo*). Among the miscellaneous varieties of vegetables are included the carrot, artichoke, lettuce, sweet potato, brinjāl (*Solanum Melongena*), potato (which is successfully cultivated not only in hilly districts but also in many places in the plains), tomato, *Amaranthus paniculatus* and other species of *sāg* largely used as a vegetable, the white goose-foot (*Chenopodium album*), beet, the climbing spinach (*Basella*), *Dioscorea sativa* and other species of yams, onion, garlic, the large arum, and *Alocasia*. Vegetables.

A great number of fruits are cultivated, ranging from the temperate kinds grown in the hills to the tropical kinds of the plains. The principal are the custard apple (*Anona squamosa*), bullock's heart (*A. reticulata*), sour sop (*A. muricata*), many sorts of oranges and limes (for which Nāgpur and the Khāsi Hills are famous), pummelo, wood apple (*Feronia Elephantum*), the ber (*Zizyphus Jujuba*), the vine (thriving in the drier districts), the lichi (*Nephelium Litchi*), the cashew-nut (*Anacardium occidentale*), and tamarind. The almond, peach, strawberry, loquāt (*Eriobotrya japonica*), apple, and pear, all fruit Fruits.

well at a considerable altitude in the hills, while some varieties have been found to succeed in the plains. The guava (*Psidium Guyava*), Indian plum, pomegranate, papaw (*Carica Papaya*), melon, sapodilla (*Achras Sapota*), Cape gooseberry (*Physalis peruviana*), fig, jack-fruit (*Artocarpus integrifolia*), banana, pineapple, and coco-nut are all well-known. In addition, many wild fruits are eaten by the forest tribes.

Mango and *mahuā*. The most important fruit from an economic point of view is the mango, which in favourable seasons forms the chief food of the poorer classes for several weeks in parts of Northern India. The ordinary common variety is easily raised from seed over a large part of India, while superior kinds are propagated by grafting, the most celebrated being those known as Mālda, Bombay, and Multān. The *mahuā* (*Bassia latifolia*) also supplies large stores of food, the yellow waxy flowers, which fall off the tree in April, being eaten both raw and cooked, and also used for distilling liquor. The fruit is edible, and the seeds yield a valuable oil.

IV. Cattle—Agricultural Live Stock

Number of cattle. In 1903–4 British India outside Bengal possessed rather more than 29,500,000 bulls and bullocks, 21,500,000 cows, 12,500,000 buffaloes, and 25,000,000 young stock. Complete figures in Bengal are available for only four Districts. The figures returned by some of the Native States in 1903–4 are believed to be much understated; their aggregate total under the four classes above named exceeded 9,000,000.

In western countries cattle are bred principally for milk and meat production: in India cows are kept chiefly to produce work cattle, and milk is largely obtained from buffaloes. Camels are employed for tillage to some extent in Northern India, but in the country as a whole agricultural operations and also the transport of goods by road mainly depend upon the draught power of bullocks and male buffaloes. There are numerous indigenous breeds of cattle, which differ to a remarkable extent in size, type, and other respects. Nearly all the large pure breeds have homogeneous colouring, the prevailing tints being white and grey. In areas where little attention is given to breeding the colours are variable, and spotted cattle abound. In the north-east of Madras hornless cattle are fairly common; elsewhere all cattle are horned. The characteristic hump is better developed in some breeds than in others, but is prominent in all. Bullocks which are suited for slow and heavy

General characteristics.

work are shaped differently from those adapted to quick and light labour. Those used for the former purpose have usually heavy heads, long pendulous ears, thick short necks, coarse leg-bones, big feet, much loose skin on the neck, dewlap, and sheath, and no particular droop in the hind-quarters. The best cattle for quick work have clean-cut heads, fiery tempers, short erect ears, thin necks, compact rounded bodies, small hard feet, a very decided droop in the hind-quarters, and little or no loose skin on the neck, dewlap, and sheath.

A very considerable proportion of the cattle are old and decrepit, and are therefore useless for breeding or for work, but are maintained owing to the sanctity of the cow among the Hindus and their general disinclination to take life. These useless cattle are the first to succumb during periods of scarcity and famine.

In the deltaic areas, and in the rice tracts generally, the cattle are miserably weak. Grazing lands are here limited, or totally wanting, and the only fodder available in any quantity is rice straw, which provides little nourishment. Little or no concentrated food is given even to the working cattle in busy seasons.

Cattle of Peninsular India.

Throughout the highlands of Peninsular India large areas of poor soil are cultivated, and the areas usually available for grazing are still poorer, having thin rocky soils which chiefly produce spear-grass. The Ghāts, Sātpurās, and other hills provide large supplies of grass in ordinary years; but the Ghāts are unsuitable for cattle breeding, owing to the excessive rainfall and the very inferior quality of the grass. In Peninsular India good grass is not found where the annual rainfall much exceeds 40 inches. Efforts are made to give reasonable facilities for grazing on the forest lands; but this has necessarily to be regulated in the interests of forest growth (see chap. ii). In some parts of Peninsular India therefore the cattle are extensively fed by hand on the produce of arable areas. The number of breeding cattle owned by an ordinary cultivator is here generally small: he may have one or two cows and a few head of young stock. The cattle of each village are herded together by children, early castration is not practised, and the mating of animals is altogether uncontrolled. After harvest there is some grazing in the stubble and on the boundaries of fields, but for six months in the year any herding that is required is to keep the cattle out of the crops. This system, if system it can be called, has resulted in producing cattle of very mixed type and generally of an inferior class. General

improvement is hopeless without assured fodder supplies and more careful breeding.

There are, however, localities in Peninsular India where good cattle are profitably bred in extensive ranges of good grass land which yields fairly abundant pasturage at all seasons. Such lands are usually upland tracts with a rainfall of 30 or 40 inches, naturally well-drained, and freely shaded by trees.

The breeding grounds of the Nellore cattle in Madras, of the Gir cattle in Kāthiāwār, and of the Khillāri and Mālwi cattle in the Sātpurās and in parts of Central India, Hariāna, and Sind exhibit some or all of these favourable natural conditions. Moreover, on the arable plains at lower levels a considerable variety of cultivated crops are grown, and nutritive fodder can therefore be obtained to supplement the natural supply if this be scanty. In these cattle-breeding areas the owners are chiefly professional herdsmen with comparatively large herds. The young bulls which are not required for stud purposes are either castrated early or sold young, while the young stock are rarely housed or tied and get a healthy amount of freedom on the grazing ground.

Cattle of Gujarāt.

The finest cattle in India are bred in Northern Gujarāt, in tracts of good grass land which extend round the Rann of Cutch and northwards into Rājputāna. The deep alluvial loamy soils of this tract are very suitable for rearing young stock; the arable fields are quite as fertile as any part of India; pulse crops are extensively cultivated, producing excellent fodder which is available when the grazing gets bare. Gujarāt was formerly regarded as fairly safe from famine, but the calamities of 1899–1901, which were accompanied by very heavy cattle mortality, dissipated this illusion.

Cattle in Northern India.

In the north of India the pressure of population entails the occupation of almost all cultivable land. The absence of rich grazing ground there makes breeding operations almost impossible, except in a few localities.

The Amrit Mahāl breed.

The characteristics of the pure breeds can only be very briefly sketched. Mysore has a far-famed breed of cattle, which is characteristically different from every other Indian variety. The purest strain is the Amrit Mahāl, which stands in relation to other Indian breeds much as the thoroughbred horse to horses generally. These cattle are of medium size and white or grey in colour. They are fiery tempered, and very active, enduring, and hardy. The bullocks are essentially suitable for road work, and are capable of quick, long journeys

under a light or moderate load. They have fine heads, alert ears, and long pointed horns, while the compactly proportioned frame, the shapely limbs, and the hard black feet indicate endurance, activity, and strength. This breed matures very slowly, and the cows are poor milkers. Pure Amrit Mahāl bullocks are worth Rs. 300 or Rs. 400 or more a pair, according to quality and size.

Nellore and Arvi cattle.

Nellore cattle are bred chiefly in and near the Madras District of that name. They are large, and usually white or grey in colour. They vary in type, indicating mixed breeding within recent times, and are of common origin with the Kistna valley cattle of Bombay. Many of the cows milk well. The larger bullocks, which when young are worth Rs. 300 or more a pair, are suited for slow heavy draught. Many medium-sized bullocks are used for cart and field work, particularly in the northern Districts of Madras. The Arvi cattle, the largest and best in the Central Provinces, are of much the same size, colour, and type as those of Nellore, though the cows do not milk so well. The bullocks are strong, but not active.

Mālwi and Kherī cattle.

The white or grey Mālwi breed is common throughout Central India. The animals are particularly true to type, the head and horns being specially characteristic, and they have been bred pure for a long period. Large droves of young bullocks are driven annually into the Deccan for sale, and are in keen demand by well-to-do cultivators, a good pair, when broken to work, being worth Rs. 150 or Rs. 175. They are spirited, active, and strong, and equally adapted for plough, cart, or well work. A pure Mālwi bullock is very shapely, the body being wide and deep but not long, the limbs well set, and the feet hard and round. The cows are poor milkers. The Kherī cattle of the United Provinces closely resemble Mālwis.

Gīr cattle.

A breed noted for its milk is reared extensively in herds in the Gīr hills and forests in the south of Kāthiāwār. Pure Gīr cattle are remarkably true to type, and in several respects characteristically differ from other Indian varieties. Two colours, or two shades of colour, the one blending into the other in a curious way, are common. An extraordinary development of frontal bone gives the forehead a very prominent rounded appearance, and the ears droop as in a lop-eared rabbit, those of a calf reaching to the nostrils. These cattle are fairly well proportioned and of medium size. The cows breed irregularly, and when stall-fed often get irritable in temper and may there-

fore soon go dry. They yield up to 12 seers (24 lb.) of milk per day. A good cow is worth about Rs. 60 in Kāthiāwār. Bulls and bullocks are alike used for work, but they are slow and when old get very lazy. They require shoeing on account of the softness of their feet, which are large.

Gujarāti cattle.

The Gujarāt cattle are the finest breed, for general agricultural purposes, in India. The best are known as Kānkreji or Wadiāl cattle. They are white, silver grey, grey, or dark grey in colour. They stand high on the leg, but are otherwise excellently proportioned. The head is carried high, and the spiral horns, which are massive in old bullocks, give a bold, attractive appearance. The ears are very characteristic, being large, pendulous, and open. The legs are particularly shapely and well placed, and the feet small, round, and durable. Gujarāti cattle are both active and strong. At ordinary field work they walk very fast, and draw a cumbersome heavy-laden cart through sandy roadways at an astonishing pace. They trot fairly fast, but with rather an ungainly action. The cows are generally poor milkers, but breed regularly. A heifer can be used for breeding when about three years old, and a bullock is at work at four or five. Prices vary with size and quality: a handsome well-matched pair of bullocks is worth Rs. 250 or more.

Hānsi cattle.

The Hānsi or Hariāna breed, the best specimens of which are not unlike Gujarātis, consists of large white and grey cattle, bred in the Eastern Punjab. The breed is less noted now than in former days, but still yields good cattle. The large Government cattle farm at Hissār breeds bulls for distribution among cultivators, and supplies the Commissariat with heavy transport bullocks. Many of the cows are exceptionally good milkers, and have for this reason been taken in large numbers to other parts of India, the home area thus losing its best cattle. The breed will in time regain its old reputation, owing to the distribution of selected bulls, and the keen demand for good bullocks in the new irrigation colonies of the Punjab. A pair of young bullocks is worth Rs. 160 to Rs. 200 in the breeding district.

Lower Sind cattle.

The cows of the lower Sind breed are generally good milkers. They are owned by Muhammadans, who do not usually cultivate land, and move their cattle from one jungle pasture to another as occasion requires. Ordinary herds number about fifty. The cattle vary a good deal in colour and appearance: the majority are a deep red, with occasional white markings. The best cattle are of medium size, have

very short legs, and are massive, long, and wide. The head is heavy; the horns coarse; the neck thick and short, with much loose skin between the jowls and dewlap—points more commonly found in a breed valuable for meat. The milking capacity of the cows has been improved, because the best bull calves of the most efficient milking cows are invariably selected as sires. The cows breed regularly and yield up to 30 lb. of milk a day in Sind, where they are worth from Rs. 45 to Rs. 60 each. Sind cattle are very docile, and the bulls need not therefore be castrated for work. A strong young pair can be bought for Rs. 80. They are, however, too slow for light field work, and not strong enough for heavy cartage.

Montgomery cattle.

The Montgomery cattle in the Punjab rival those of Hānsi as a useful milk breed. They are small, shapely, and short-legged, with fine heads, short horns, thin necks, fine leg-bones, small feet, and exceptionally long thin tails. The colours vary, but most are dark red, pure white or grey; spotted cattle are, however, common. Montgomery District has a very light rainfall, with large stretches of scrub grass land. Canal-irrigation is now rapidly extending into the District, and the best cows have been taken by their owners into the new canal colonies. Ordinary cows giving 16 lb. of milk daily are worth Rs. 50 or Rs. 60 each, but a first-class cow will fetch Rs. 100 or more.

Bengal cattle.

The cattle in the deltaic areas of Bengal are very inferior. Even in Bihār and other areas of moderate rainfall they are not good, although the soil is rich and excellent crops are grown. In these parts of Bengal the rural population is very congested and the average holding is small. Individual owners can thus keep few cattle, and no attention is paid to systematic breeding. Bihār is overrun with *pols* (bulls dedicated to the gods). These are very fat, and comparatively useless for stock purposes, but do much harm by eating and trampling the growing crops.

Buffaloes.

General characteristics.

Buffaloes thrive better than ordinary cattle in districts of heavy rainfall, and in rice tracts male buffaloes are extensively used for both tillage and road work. The best are produced in districts of moderate rainfall, where conditions for cattle-breeding are favourable. They should have access to deep water, or be bathed, twice daily. Their sparse coarse hair is usually shaved off several times a year. Buffaloes vary in colour, but the majority have black hair and shining black skins. Some have white markings, and a few are grey or

light dun, and very occasionally albino. Their lowing differs from that of kine, and they have no hump, while buffalo milk is much richer in butter fat than cows' milk. Female buffaloes have strong maternal instinct, and become much attached to particular companion animals and to the attendant who milks and feeds them: a buffalo usually refuses to give milk if there is any disturbance of these relations. Wild bulls occasionally breed with the domesticated cows. Large male buffaloes are used for heavy cartage, particularly in towns: they can draw heavier loads or carry heavier packs than bullocks of the same size. They are generally very cheap, and unless there is abundant pasture it does not pay to make a special business of rearing them.

The breeds.

The buffaloes of Southern India are small, short-legged, and round-bodied, and are not nearly so valuable as the larger breeds found farther north. The Deccan and Central India buffaloes are rather poor milkers, with characteristic long sharp horns. There is not much difference in size and general conformation between these and Gujarāt buffaloes, except that the latter have shorter blunt horns, which turn up in an easy curve on each side of the neck. The best Gujarāt buffaloes are bred in Kaira District and in the adjoining Baroda territory. This breed is commonly called Surati. A good specimen has a long rounded body, but the withers are high and thin, and the fore-quarter rather light. The legs are short and thick, and the feet large. A good female buffalo gives up to 30 lb. of milk a day, and costs from Rs. 125 to Rs. 140.

Jāfarābādi buffaloes.

Jāfarābādi or Kāthiāwār buffaloes are much larger. They stand high, and the legs and feet are coarse and big, and the dewlap is characteristically heavy. The withers stand up like a spine, and the pelvic bones are very prominent; there is extraordinary development of horn and frontal bone, and the eye-sockets thus become surrounded so that the eyes appear deep in the head. Jāfarābādi buffaloes are distinctly ugly, but have the advantage of being good milkers. In the Gir hills of Kāthiāwar, where they are bred, good buffaloes yield 15 to 20 seers (30 to 40 lb.) of milk daily, and are worth about Rs. 150 each.

Delhi buffaloes.

The finest animals of the Delhi breed are found in Rohtak District west of Delhi, but this variety is common in the United Provinces, the Punjab, Rājputāna, and Sind. The best specimens are as heavy as Jāfarābādi buffaloes, but much better proportioned. They are massive and square

built, but heavier in the hind-quarters than in front. The horns curl in a characteristic way over the head, somewhat like those of a ram; the udder is generally very large, and also well shaped. A good Delhi buffalo cow is worth Rs. 150 to Rs. 200, and gives in the north of India as much as 25 seers (50 lb.) of milk per day. This quantity is sufficient to yield about 4 lb. of butter.

Exports of hides.

Hides are exported in very large quantities. During the ten years ending 1900 the average annual value was more than 2 crores. In the famine year 1900–1, when mortality among cattle was terrible, the exports increased to 5·3 crores. The value in 1903–4 was 3·2 crores.

Dairying on European principles.

Dairying on European principles was practised in India to a moderate extent in 1890. It has since extended very considerably under Government supervision. The Bombay Agricultural department gave an impetus to the industry by establishing a dairy farm, by securing the services of an expert from Sweden, and by organizing demonstrations of improved methods. The expert was transferred to the Agricultural department of the United Provinces, and was subsequently allowed to purchase the Government dairy farm opened near Alīgarh. It was soon found that good butter was readily saleable at much higher rates than the common country product, *ghī*. It was also shown that in the larger towns and cantonments there is a large demand at high rates for milk from cows or buffaloes which are properly fed and milked in sanitary surroundings.

Cantonment grass farms.

Cantonment grass farms and dairies have been successfully established in many places under military control. These not only supply the troops with pure milk and other dairy products, but also form centres where men have been trained for the military grass farm and dairy operations, which are extending.

Increase in butter-making.

Dairy machinery is admitted duty free into India. Separators, churns, and butter-workers have been imported in large numbers. Many separators have been set up in villages where milk is cheap. The cream is sent by rail to important towns, and there made into butter which is sold fresh locally or is tinned for sale throughout India or for export. Prices ruled high at one time. Increased production and competition have lowered them, but the industry is still profitable, especially to those who can guarantee the purity of their dairy produce; and there is a large demand both in India and for export.

The following table shows the value of the external trade in dairy produce in 1903–4:—

	Quantity (lb.)			Value (Rs.)		
	Butter.	*Ghi.*	Condensed milk.	Butter.	*Ghi.*	Condensed milk.
Imports .	277,112	127,868	4,137,066	3,16,536	50,722	11,34,187
Exports .	289,425	5,390,865	..	1,97,949	22,90,825	..

Half the butter exported goes to Ceylon, while *ghi* is largely sent to the Straits Settlements, Natal, Aden, and British East Africa, for the consumption of Indian emigrants.

Difficulty of improving Indian cattle.

Over the greater part of India the problem of improving the breed of cattle is, for various reasons, very difficult. Maimed, old, and worthless cattle are kept alive until they die naturally, although they give no return, except manure, for the food they consume. Fodder from natural grazing or cultivation is so scarce in many tracts that cows and young stock annually undergo semi-starvation in the hot weather. The working cattle are somewhat better cared for. The lack of care in mating cattle has already been referred to. The superior breeds which are reared under favourable conditions have not deteriorated, and with the spread of cultivation have increased in numbers, and to a certain extent supplied the working cattle required by extended irrigation. This extension has in turn provided a largely increased fodder supply.

Effects of crossing.

Spasmodic efforts have been made for many years to improve Indian cattle by the distribution of bulls to District Boards and otherwise, but no results of importance have been recorded. In many cases failure has been due to the selection of unsuitable bulls; but in addition to this, half-bred cattle contract rinderpest and other diseases in a most virulent form, and rarely recover under treatment, while many indigenous breeds are comparatively immune.

The Civil Veterinary department.

The establishment of a Civil Veterinary department in each Province, with District veterinary dispensaries and itinerating native officers, has done much to control rinderpest by inoculation, and other less deadly cattle diseases by segregation and treatment. The advantages are generally acknowledged by the people and are greatly in request where best known.

The same department has also general charge of the

arrangements for breeding or rearing bulls for distribution. It is only within recent years that the work has been organized on any definite plan, and no appreciable results have yet been obtained.

General schemes for cattle improvement.

It is recognized that the purity of the best indigenous breeds must be maintained, and that in areas where the cattle, though active and hardy, are inferior and small, they cannot be improved except by breeding from the best of their own kind. With this purpose in view, Government bull-breeding and bull-rearing farms are being started. These farms are stocked with cows and bulls carefully selected from the superior pure breeds; and as the breeding is under control, the young bulls are suitable for distribution among cattle of the same breed in tracts which are favourable for cattle-breeding. The most important of the existing farms are at Hissār in the Punjab and at Chharodi near Ahmadābād. The breeding of pure Hānsi cattle at the former will exercise a powerful influence in improving the cattle of the rapidly extending irrigated areas in the Punjab and Sind, and probably also in parts of the United Provinces, Rājputāna, &c. The Chharodi farm can maintain about 1,000 cows of the Gujarāt breed, and is now supplying bulls to the surrounding breeding tracts in British territory and Native States. Smaller farms have been established by the Imperial Agricultural department at Pūsa, by the Hathwā Estate (Bengal) on the Siripur farm, by the Government of the Central Provinces at Nāgpur and Hoshangābād, and by the Bombay Government at Mānjri in Poona District. In Mysore the Amrit Mahāl breed has long been kept up by the State.

Preservation of cattle in famine.

Hay-making is not practised by the Indian cultivator. Forest grass is annually allowed to rot on the ground, and reserve stocks of fodder are not maintained. When famine is imminent, breeders will spend all their savings and make heroic efforts to keep their cattle alive. Such efforts were, however, unable to prevent a mortality of 60 to 75 per cent. in some Districts of Gujarāt in 1899–1900. Fodder famines over extensive areas are rare; but dried grass and the straw of arable crops are so bulky and light that transport is costly, while pressing into bales is expensive, though it reduces the charge for freight. The poorer owners of cattle are thus unable to import fodder or the more valuable auxiliary foods, such as oil-cake and cotton-seed, the price of which rises in dry seasons. In 1899–1900 Government attempted to sell imported fodder in famine tracts at less than cost price, but

relief was limited by the fact that the railways were unable to cope with the traffic. Although forests are temporarily thrown open to grazing in years of famine, the number of cattle which can be admitted is limited, while the difficulty of transport is often insuperable. In some parts of India estimates are made periodically of the number of cattle for which grazing might be required, and a provisional scheme is drawn up showing to which forests they could be sent.

Need of storing fodder.

These remarks point to the need of gathering and storing surplus fodder in good years. It is on this source of supply that reliance must be placed to preserve useful cattle in years of scarcity in the areas most liable to famine. The grass now wasted, if cut at the right time, stacked and properly protected against rain, would remain good for years, and with oil-cake and other concentrated foods would form a substantial reserve against famine. The subject is, however, difficult owing to the question of expense. The fodder crops which are commonly grown are as nutritive and productive as those of any country in the world, but the area occupied by them is smaller than suffices.

Sheep and goats.

Sheep and goats are bred most successfully in areas receiving a moderate rainfall. Upland or well-drained soil, with sparse jungle growth and a considerable variety of natural herbage, is good if of sufficient extent. In Peninsular India the shepherds own large flocks with which they wander from place to place in the fair season, when arable land is usually clear of crops. The sheep and goats graze during the day and are folded at night on fields, so that they may be fertilized by their droppings. Such supplies of manure are paid for in either cash or grain by the cultivators whose fields have benefited. A few of the sheep and nearly all the goats are milked regularly, and the women make *ghī* each morning before striking camp.

Sheep.

There are a number of Indian breeds of sheep, each more or less of a nondescript character, but all are inferior whether as mutton or as wool-producers. The wool in the colder parts of the north is generally white and of fair quality, while that obtained from the breeds of Peninsular India may be white, red, tawny red, brown, black or grey, and is usually short, and coarse or hairy. A fleece rarely weighs more than $1\frac{1}{2}$ lb. Sheep are clipped twice in the year, in March and October. A ewe breeds when one and a half to two years old, and has rarely more than one lamb at a birth, but may produce young twice in a year. In 1903–4 the number of

sheep in British India (excluding Bengal, for which there are no returns) was 17·9 millions.

Many of the sheep of Northern India have long drooping ears, large noses, and big ugly heads, which are red or black, the colour also extending down the neck. Sheep of the Deccan type are of all the colours mentioned above. They are hardy, small, compact and shapely, with short legs. The ewes, and sometimes the rams also, are hornless. Rams of this breed, with horns and frontal bones developed to an unusual extent, are trained for fighting.

Sheep in the north and south of India contrasted.

No systematic efforts have been made to improve Indian sheep. On a small scale useful results were obtained by crossing Deccani ewes with Dumba rams (the fat-tailed sheep of Afghānistān). The half-breeds yield good mutton, while their wool is of fine quality and long, like that of the pure Dumba.

Improvements.

The varieties of goats are as numerous and as badly defined as those of sheep. Some of the long-haired breeds of the lower ranges of the Himālayas are large and exceedingly handsome, while those bred in parts of the Punjab, Rājputāna, and Sind are scarcely inferior. The goats of Southern India, however, are as a rule gaunt in appearance and badly proportioned, but are hardy and active, and can exist on any kind of vegetation.

Goats.

Goats are valued for their meat and milk, and in the Himālayas for their hair. Some breeds are exceptionally good milkers; notably the small, shapely, short-legged breed of Surat and other parts of Gujarāt, and a breed of very similar type found freely distributed through the drier parts of Bengal. A good milch goat gives 2 seers (4 lb.) of milk daily, and sometimes more. Goats are very prolific. They breed when young, and often twice in the year, producing generally two and often three kids at a birth. The flesh of goats is largely used in India instead of mutton.

In British India (excluding Bengal, for which there are no figures) there were 24·9 million goats in 1903–4, while in the Native States which furnish returns the number of goats and sheep together was returned as 6·4 millions.

Statistics.

Goat and sheep-skins are largely exported, the average weight during the ten years ending 1900 being 100,000 cwt., valued at 94 lakhs. In 1903–4 the exports weighed 265,000 cwt., worth 267 lakhs.

The statistical returns for 1903–4 give the number of horses and ponies in British India (excluding Bengal) as 1·3 millions,

Horses.

while the number in the reporting Native States was 92,000.

Government horse-breeding operations.

About the beginning of the nineteenth century a Stud department was organized by Government to breed horses for the use of the Bengal army, but it was abolished in 1871 by Lord Mayo as extravagant and inefficient. Subsequently the present system of horse-breeding was gradually developed by the Civil Veterinary department. The object of the Government horse-breeding operations is to obtain remounts suitable for the Indian cavalry and the police. The breeders present their mares for inspection, and such mares as are considered suitable are branded. In 1902–3 there were 21,911 mares on the register. These are covered free of charge by Government stallions. The stallions are distributed to those districts which are most suitable for horse-breeding, and in which there are sufficient numbers of suitable mares. Experience has proved that Arab and thoroughbred (either English or Australian) horses are the most suitable sires. There were 349 Government stallions on the register in 1903. The majority were distributed through the Punjab and the United Provinces. The other important centres where remounts are bred are Baluchistān, Sind, and Bombay (the Deccan, Gujarāt, and Kāthiāwār). In March, 1903, the administration of horse-breeding in certain selected districts was handed over to the Army Remount department. The Civil Veterinary department continues to control horse-breeding in less favourable areas.

Horse fairs.

The purchase of remounts is facilitated, and horse-breeding has been gradually encouraged, by prizes offered at old-established fairs. Breeders show great keenness and emulation at these fairs, and exhibit their brood-mares and young stock in the pink of condition. Remount officers make their selections and pay prices which vary according to age. The purchased young stock are subsequently reared at the remount depôts at Mona, Bābūgarh, and Ahmadnagar. In 1902–3 1,293 country-bred remounts were purchased by Government.

Mules and donkeys.

The statistical returns for 1903–4 give the number of mules and donkeys in British India (excluding Bengal) as 1·23 millions, and in the reporting Native States as 122,000. For many years attention has been given to the breeding of mules for military purposes. In 1902–3, there were 492 Government donkey stallions on the register. These were chiefly distributed in the Punjab, the United Provinces, the North-west Frontier Province, and Sind. About 24,000 pony mares and 1,800 donkey mares were covered in that year. The stallions are chiefly Italian and Cypriote, but a considerable number have

also been imported from Spain, Persia, and America, and a few have been bred in India. A small donkey-breeding stud has been established on the Hissār farm.

In 1903–4 the statistical returns gave the number of camels in British India as approximately 382,000, and in the reporting Native States as 43,000. The greater proportion belong to the Punjab, Sind, and Western Rājputāna, where camels are largely used for agricultural operations instead of bullocks. Camels.

Table IV at the end of this chapter gives the numbers of live stock of various classes, and of ploughs and carts, in 1903–4 in the various Provinces and in certain Native States. Tabulated statistical figures.

V. Tenures, Credit, Research, and Administration

There are certain features connected with the tenure of agricultural land in India which it is desirable to bear in mind. While in some parts of the country the land is owned by large proprietors, and in others it is held by numerous peasant occupants subject to no private landlord, yet whatever the form of proprietorship or semi-proprietorship may be, it is the almost universal rule that the cultivating unit, the holding of the peasant occupant or the tenant, is far from large, and is indeed in some areas excessively small. Unlike many countries which possess similar stretches of cultivated plain, India knows little or nothing of *latifundia*, and farming on a large scale is quite exceptional. Even where the proprietary unit is of the vast dimensions prevalent in parts of Oudh and Lower Bengal, the bulk of the property, including large portions of the demesne land, is held on lease by a considerable number of small tenants, who, whether holding direct from the owner or through an intermediary, constitute from the agricultural point of view an equivalent number of practically independent cultivating units. The size of the agricultural holding differs considerably in different parts of India, according to the character of the soil, the facilities for cultivation, and other similar considerations; but its general character may be learned from the facts that in the ryotwāri areas of Madras the average size of the parcels held by occupants direct from Government does not exceed eight cultivated acres, that in the Punjab the average size of the cultivating unit (whether under tenants or proprietors) is three cultivated acres, and that in the more thickly populated areas of Bihār the tenant's holding averages less than half an acre. A large proportion of the Agricultural tenures.

holdings is held by the classes known as proprietors, occupants, occupancy tenants, and the like, whose rights are subject to devolution by inheritance, and the customs which regulate inheritance are almost universally such as to encourage constant subdivision. The practice of joint cultivation is indeed carried out to an extent unknown in most parts of Europe; but with increasing numbers there is an increasing tendency towards the partition of cultivating units, and the *morcellement* of the land that has resulted in certain parts of India is accompanied by advantages and drawbacks differing little in their general features from those which characterize the corresponding movement in the more thickly populated areas of Europe.

Agricultural credit.

Generally speaking, therefore, the agriculture of India is in the hands of small men, and the capital required for the cultivation of the soil is supplied in small sums by small capitalists to men of small commercial intelligence. The peasant in India, as in most other agricultural countries, works on borrowed capital; and the question whether he is more or less indebted than his compeer in other countries is open to discussion, but there can be no doubt that in certain parts of India at least the indebtedness of the peasant is economically excessive. This feature of the agricultural situation is largely the product of the last half-century. On the one hand, the land, which is the peasant's ultimate security, has risen immensely in value under British rule, and the peasant has been tempted by the enhancement of his security to plunge into unnecessary debt. On the other hand, the increase in the value of the security has had little or no effect on the price of the capital supplied, and the money-lender has utilized the commercial helplessness of the uneducated peasants and their increasing competition for loans to maintain rates of interest which tend to make the business of agriculture impossible. On the one hand there is excessively wide credit, on the other excessively dear money; and the agriculture of India has suffered equally from the one and from the other.

The excess of credit has its basis in the fact that land which formerly had little or no market value has under the light assessments and the enforced peace of British rule acquired a value which renders it a transferable commodity, and in some parts of the country the land itself has passed largely, either by sale or by usufructuary mortgage, into the hands of the money-lending class. This transfer of the land to a class which has, as a rule, no sympathy with agriculture

and merely speculates on quick returns, has contributed not only to the discontent of the peasantry, but also to the impoverishment of the soil; and the Government has in some parts of India decided that the only means to save the country from these evils is the drastic measure of curtailing the peasant's right to raise money on his land. It is intended by such measures to leave in the peasant's hands all the credit needed to maintain a profitable agriculture, while at the same time cutting off the further credit which tempts him to extravagant borrowing for purposes unconnected with his cultivation, and ultimately deprives him of his property in the land.

The further danger to agriculture, which lies in the dearness of money, is largely the consequence of the fact that from time immemorial the small village banker has had the monopoly of supplying money to the agriculturist. It is recognized that under existing social conditions no better agency than the village money-lender is possible, but so long as he requires immensely high rates of interest other agencies should also be open to the agriculturist. The Government has endeavoured to supply this want, both by lending money itself (known as *takāvi*), and by encouraging the peasants to form credit associations of a co-operative character. The loans made by the Government amount on the average to more than £500,000 sterling per annum, and the total outstanding on March 31, 1903, exceeded £2,000,000 sterling. These sums are advanced at 5 to 6¼ per cent., as against the ordinary rate of 12 to 24 per cent. exacted by the village money-lender. But the Government advances are made only for specific purposes connected with agriculture (improvement, seed, cattle, &c.), they entail more formalities than the village loan, and the repayment is enforced with greater rigidity, so that hitherto the Government loans, though serving a useful purpose (especially in times of famine), have not had any very serious influence on the agricultural credit of the country. The co-operative system of credit, on the other hand, is still in its extreme infancy. Facilities have been given, by an Act of 1904, for the formation of co-operative credit societies based on the Raffeisen plan so successful in Central Europe, and encouragement has been afforded by the state in several ways towards the formation of such societies, but they have not yet had time to take root or develop. Further plans for providing cheap money have from time to time received, and are still receiving, the attention of Government,

but up to the present the bulk of the agricultural capital is supplied by local money-lenders under conditions prejudicial to development.

Agricultural improvement. To these conditions of credit, combined with a certain constitutional want of enterprise among the bulk of the peasantry, must be ascribed in the main the comparative neglect until recent years of land improvement in India. The improvements required differ in character, moreover, from those to which we are accustomed in the British Isles. Manuring, drainage, and the construction of farm buildings, though not lacking in importance, are improvements of far less moment in India than those connected with the application of water to the soil, and there are large tracts in India where improvement denotes simply irrigation and nothing else. The larger works of irrigation represented by the immense canals of the alluvial plains have been undertaken by the Government itself. Certain smaller classes of irrigation extending over comparatively restricted areas have been originated and controlled by associations formed among the villagers, subject to varying degrees of Government supervision. The main opening for individual enterprise lies in the construction of wells and small embankments, and there has of late years been a very encouraging development in this direction. The number of permanent wells in the four Provinces where this form of irrigation mainly prevails was found by the Irrigation Commission of 1901–3 to have increased from 1,288,803 to 1,654,898, or by more than 28 per cent., in the decade preceding their inquiries. Towards individual efforts of this character the state has always maintained a favourable attitude. Loans for the purpose of agricultural improvement are, as has been noted above, available on comparatively easy terms, and the sums advanced by the Government for this purpose average about 27 lakhs of rupees per annum. Improvements, whether made from Government loans or otherwise, are exempted from enhancement of the land revenue either in perpetuity as in Southern India, or for long periods of years as in the north. The tenancy laws, moreover, usually allow both landlord and tenant to effect or obtain improvements under certain restrictions, and, while giving the landlord a right to enhancement of rent for improvements effected by him, forbid enhancement on improvements effected by the tenant. The details of the systems under which state loans are granted for improvements, and under which improvements are exempted from enhancement of revenue or rent, have from time to time

been subjected to special investigation, and the principles on which they are based have been gradually developed on lines of increasing liberality.

Agricultural associations.

Agricultural co-operation, so far as it is represented by the coparcenary cultivation of joint owners or tenants and by certain primitive systems of mutual assistance at times of ploughing and harvest, is by no means uncommon in India, but associations of the European type for the purchase of seed and machinery or for the sale of cattle and produce are practically unknown. Insurance of animals, or of crops, or of farm buildings, whether by co-operation or otherwise, is also exceedingly rare. Agricultural newspapers are very few in number and restricted in circulation. In the tracts held by large landowners there are associations of landlords to protect their interests as such, but associations for the encouragement and improvement of agriculture, though not unknown, are as yet rare and their activity has hitherto depended largely on official support. There are, however, indications that the benefits of associations for agricultural purposes are becoming more clearly realized, and further developments in this direction may be expected.

Agricultural experiment and research.

Agricultural research and experiment in India are still in their infancy. What little has been done has been achieved almost entirely by state agency, and that little is, for reasons which will be noticed below, of very recent origin. There have, indeed, for some time past been experimental farms in various parts of India under official control; but they have been for the most part in the hands of amateurs, and though good work has been done at some of them, they have as yet had no marked effect on the agriculture of the country. It was not till 1892 that an expert officer of Government was appointed to study and advise on matters of agricultural chemistry; and it is only within the last few years that serious efforts have been made, by the appointment of further experts, to commence the investigation of problems connected with the economic botany, the entomology, and the agricultural bacteriology of the country. Arrangements, which have been materially helped by a munificent donation of £30,000 from an American gentleman, Mr. Henry Phipps, have recently been made for the concentration of agricultural research at Pūsa in Tirhut, where special laboratories, attached to a large experimental and seed-growing farm, are being erected for the prosecution of technical investigations of an agricultural character. Similar investigations have been started in one or two of the Provincial centres, but they

are at present on a small scale and capable of considerable further development.

Agricultural education.

The education of the agricultural classes, both general and technical, is at present in a similarly undeveloped position. The vast majority of the agriculturists of India are illiterate. The education provided for those who attend school has been to a large extent literary; and although efforts have been made of late years to bring the education of the agricultural classes more into contact with their daily life, there has not yet been time for this improved system of education to have any marked effect. Technical education in agriculture has been hitherto represented by the instruction given at the Colleges of Poona and Saidapet, and by schools at Cawnpore, Nāgpur, and Sibpur; while for teaching of an advanced type Indian students have had to attend the educational institutions in England. It is now proposed to reorganize the whole system of agricultural education in India, by opening at Pūsa in connexion with the Research Institute above mentioned a fully equipped Agricultural College with an advanced course, and by providing in each of the larger Provinces a corresponding institution with a three years' course leading up to the advanced instruction to be given at Pūsa. It is hoped that, with the completion of this scheme, the agricultural education of the country may be put upon a satisfactory basis.

Agricultural administration.

From what has been said above it will be observed that there has in the last few years been a marked change in the attitude of the Government towards agriculture. Although the importance of the land revenue as a source of public income and the appalling inroads on the national wealth caused by famine had marked clearly enough the close connexion between the Government and the cultivation of the land, it was long before the state in India overcame the prejudice, imbibed from England, against spending public money on the improvement of agriculture. The first step towards a change of attitude was the constitution by Lord Mayo in 1871 of a separate department of Government for Land Revenue and Agriculture, but the department was restricted in its operation and was for financial reasons abolished in 1879. On the recommendation of the Famine Commission of 1880 the department was reconstituted in 1881, but it was still compelled from want of funds to restrict its activities almost entirely to the improvement of the land records of the country on which the land revenue is based. The necessity for a wide statistical basis was clearly pointed out by Sir E. C. Buck, and the early work carried out in some

Province resulted in the collection of an immense amount of information, which has proved invaluable. In 1889 the progress made in the organization of the revenue records was considered sufficient to justify the initiation of the agricultural side of the programme. A report was prepared to this end by an expert chemist, Dr. Voelcker, who was deputed from England to study Indian conditions; and as a result of his recommendations an Agricultural Chemist was appointed by the Government of India in 1892. The continuance of financial trouble, however, postponed further development, and it was not until the stability of exchange and the prosperity of the finances became assured that actual progress could be made. The relations of the Government towards agriculture are controlled by a Civilian Director in each Province, and in some of the larger Provinces he is helped in the agricultural part of his duties by an expert Deputy Director. Since 1901 the superintendence of agricultural interests has been entrusted to an Inspector-General of Agriculture, who acts as a technical adviser to both the Supreme and the Provincial Governments; and the chief agricultural experts of the country have been constituted into a Board of Agriculture, which is convened at suitable intervals to discuss outstanding agricultural questions and to submit recommendations to Government. These arrangements, however, are regarded as preliminaries to a more complete organization of the agricultural activities of Government, and a rapid development of the Agricultural departments, both Imperial and Provincial, is now in contemplation.

Bibliography

Sir George Watt.—*Dictionary of Economic Products* (Calcutta, 1889-96).

The Agricultural Ledger Series (Calcutta) from 1892.

Report of the Irrigation Commission, 1901-3 (Calcutta).

Kelway Bamber.—*Chemistry and Agriculture of Tea, including Growth and Manufacture* (Calcutta).

Watt and Mann.—*The Pests and Blights of the Tea Plant* (Calcutta, 1903).

J. A. Voelcker.—*Report on the Improvement of Indian Agriculture* (1897).

J. Mollison.—*Text-Book on Indian Agriculture* (Bombay, 1901).

C. Rawson.—*Report on the Cultivation and Manufacture of Indigo* (Muzaffarpur, 1904).

George King.—*A Manual of Cinchona Cultivation in India* (Calcutta, 1880).

Reports of the Famine Commissions of 1881 and 1901.

Sir James Caird.—*India: the Land and the People* (1883).

Robert Wallace.—*India in* 1887 (1888).

A. H. Church.—*Food Grains of India* (1886).

G. A. Gammie.—*The Indian Cottons* (Calcutta, 1905).

TABLE I

Classification of Areas (in Square Miles) in the Principal Provinces, 1903-4

Province.	Total area.	Net cropped area.	Current fallow.	Total occupied area.	Cultivable waste other than fallow.	Not available for cultivation.	Forests.
Madras . .	101,109	42,147	9,556	51,703	8,868	20,772	19,766
Bombay . .	115,383	42,661	17,545	60,206	12,485	30,369	12,323
Bengal . .	152,453	76,454	10,573	87,027	19,470	37,746	8,210
United Provinces	103,971	55,799	3,206	59,005	16,928	13,556	14,482
Punjab . .	89,270	38,924	3,805	42,729	28,130	12,999	5,412
Burma . .	162,530	19,679	4,934	24,613	36,484	82,808	18,625
Central Provinces and Berār .	96,710	38,611	5,131	43,742	23,747	8,256	20,965
Assam . .	28,894	7,730	1,980	9,710	12,258	3,148	3,778
Frontier Province	13,280	3,638	602	4,240	2,981	5,532	527
Total	863,600	325,643	57,332	382,975	161,351	215,186	104,088

Note.—Excluding feudatory and tributary States, and areas for which no returns exist.

TABLE II

PRINCIPAL CROPS CULTIVATED IN INDIA

Botanical Name.	English Name.	Vernacular Name in Hindustani.
Cereals.		
Oryza sativa	Rice	Dhān.
Triticum sativum	Wheat	Gehūn.
Andropogon sorghum, or Sorghum vulgare	Great millet	Juār (jowār). [*Tamil*, Cholam.]
Pennisetum typhoideum	Bulrush or spiked millet.	Bājra. [*Tamil*, Cambu.]
Hordeum vulgare	Barley	Jau.
Avena sativa	Oats	Jai.
Zea Mays	Maize	Makka or Makai.
Eleusine coracana	Small millets	Manduā or Maruā. [In Bombay, Nāgli; in Mysore and Madras, Rāgi.]
Panicum crusgalli	Small millets	Banti (Bombay).
Panicum miliaceum	Small millets	Chenā, Vari (Bombay)
Panicum frumentaceum	Small millets	Sāwān.
Paspalum scrobiculatum	Small millets	Kodon.
Setaria glauca	Small millets	Barti (Bombay).
Setaria italica	Italian millet	Kakun.
Pulses.		
Cicer arietinum	Gram	Chana.
Dolichos biflorus	Horse gram	Khulāt.
Cajanus indicus	Pigeon-pea	Arhar. [In Bombay, Tur.]
Lathyrus sativus	Chickling vetch	Kisāri.
Dolichos Lablab	Indian bean	Sem.
Cyamopsis psoralioides	Cluster bean	Guār.
Phaseolus aconitifolius	Kidney bean	Moth.
Phaseolus Mungo	Black gram	Urd or Māsh.
Phaseolus radiatus	Green gram	Mūng.
Vigna Catiang	Cow-pea	Lobia.
Ervum Lens	Lentil	Masūr.
Pisum arvense	Peas	Matar.
Pisum sativum	Peas	Matar.
Oilseeds.		
Linum usitatissimum	Linseed	Alsi.
Sesamum indicum	Sesamum or gingelly.	Til.
Carthamus tinctorius	Safflower	Kusum, Barre.
Guizotia abyssinica	Niger-seed	Kālā til.
Arachis hypogaea	Ground-nut	Mūngphali.
Ricinus communis	Castor-oil plant	Arind or Rendi.
Brassica campestris	Rape or mustard	Sarson, Lāhi.

TABLE II—(*continued*)

PRINCIPAL CROPS CULTIVATED IN INDIA

Botanical Name.	English Name.	Vernacular Name in Hindustāni.
Irrigated Garden Crops.		
Saccharum officinarum	Sugar-cane	Ukh or Ikh.
Zingiber officinale	Ginger	Adrak or Sonth.
Curcuma longa	Turmeric	Haldī.
Amorphophallus companulatus	Elephant foot	Zamīnkand.
Colocasia Antiquorum	Kacha	Ghuiyān.
Ipomaea Batatas	Sweet potato	Shakarkand.
Dioscorea	Yam	Ratālu.
Solanum tuberosum	Potato	Alu.
Solanum Melongena	Brinjāl	Baingan.
Capsicum	Chillies	Mirch.
Allium Cepa	Onion	Piyāz.
Allium sativum	Garlic	Lahsan.
Daucus Carota	Carrot	Gājar.
Raphanus sativus	Radish	Mūli.
Fibre Plants.		
Gossypium neglectum	Cotton	Paril ban, Kapās.
Corchorus capsularis Corchorus olitorius	Jute	Pāt (Beng.).
Crotalaria juncea	Bombay hemp	San, Sanai.
Hibiscus cannabinus	Deccan or roselle hemp.	Pātsan.
Fodder Crops.		
Medicago sativa	Lucerne	—
Panicum tumentorus	Guinea grass	—
Melilotus parviflora	Senji	—
Drugs, Narcotics, and Dyes.		
Nicotiana Tabacum	Tobacco	Tambāku or Surti.
Papaver somniferum	Poppy	Posta.
Cannabis sativa	Indian hemp	Bhang.
Piper nigrum	Pepper	Kālī mirch.
Areca Catechu	Betel palm	Supāri.
Piper Betle	Betel leaf	Pān.
Elettaria Cardamomum	Cardamom	Bari ilaichi.
Camellia theifera	Tea	Chā.
Coffea arabica	Coffee	Bun.
Cinchona	Cinchona	—
Indigofera tinctoria Indigofera sumatrana	Indigo	Nīl.

TABLE III

AREAS (IN SQUARE MILES) UNDER PRINCIPAL CROPS IN IMPORTANT PROVINCES, 1903–4

PROVINCES.	Rice.	Wheat.	Millets and pulses.	Sugar-cane.	Fodder crops.	Tea.	Poppy.	Tobacco.	Indigo.	Cotton.
Madras	12,935	39	25,034	86	373	19	...	226	409	2,765
Bombay	3,825	3,287	26,582	93	25	...	...	126	9	5,905
Bengal	54,535	2,357	12,413	1,008	106	212	335	840	390	125
United Provinces . . .	9,435	12,210	26,895	1,703	1,544	13	689	81	220	1,306
Punjab	1,075	12,215	13,355	517	3,330	16	14	84	84	1,637
Burma	14,542	53	2,517	20	40	3	...	100	1	249
Central Provinces and Berār .	7,014	5,273	17,018	30	430	...	...	50	...	6,495
Assam	6,188	16	157	63	57	528	...	7	...	6
Frontier Province . . .	51	1,411	815	43	80	...	...	10	...	48
TOTAL .	109,600	36,861	124,786	3,563	5,985	791	1,038	1,524	1,113	18,536

TABLE IV

NUMBER OF LIVE-STOCK, AND OF PLOUGHS AND CARTS, 1903-4

PROVINCES.*	Bulls and bullocks.	Cows.	BUFFALOES. Bulls.	BUFFALOES. Cows.	Young stock (calves and buffalo calves).	Sheep.	Goats.	Horses and ponies.	Mules and donkeys.	Camels.	Ploughs.	Carts.
Madras †	4,411,350	3,853,408	846,679	1,560,104	4,385,639	8,234,262	5,181,639	40,239	218 (m) 119,867 (d)	11	2,749,701	524,041
Bombay ‡	2,961,103	1,660,313	191,902	875,160	1,856,486	1,688,888	2,780,798	164,237	689 (m) 134,256 (d)	103,097	1,197,724	511,903
United Provinces	11,195,995	7,270,950	869,471	3,516,250	9,554,054	2,738,048	8,787,553	581,675	15,959 (m) 293,746 (d)	20,593	5,187,435	749,279
Punjab	4,095,529	3,064,010	575,471	1,885,278	3,681,891	4,084,651	5,471,962	287,224	25,416 (m) 505,661 (d)	236,799	2,073,195	261,559
Burma	1,530,846	1,269,725	388,437	369,991	1,411,402	16,005	112,179	46,598	1,194 (m) 9 (d)	1	432,633	511,330
Central Provinces and Berār.	3,722,151	2,974,654	347,374	709,260	2,394,211	488,489	1,455,903	113,386	638 (m) 31,729 (d)	521	1,215,555	617,826
Assam §	1,174,031	1,075,372	97,440	132,463	1,508,389	12,909	428,947	10,200	8 (m) 31 (d)	..	881,413	12,198
Frontier Province	368,906	261,763	11,196	122,237	229,028	433,771	434,488	24,492	9,576 (m) 85,170 (d)	19,292	184,944	4,567
Ajmer-Merwāra (including Mānpur).	77,323	81,175	4,037	24,358	41,638	207,096	255,609	2,127	4,595 (d)	1,412	35,969	10,064
Coorg ‖	34,629	26,674	11,931	7,690	19,096	629	1,755	401	4 (m) 270 (d)	..	26,979	715
TOTAL	29,571,863	21,538,044	3,343,938	9,202,791	25,081,834	17,904,748	24,910,833	1,270,579	53,702 (m) 1,175,334 (d)	381,726	13,985,548	3,203,482
Native States ¶	2,700,476	2,981,158	1,248,633		2,416,169	6,454,635		92,397	121,835	43,061	1,327,187	321,941
GRAND TOTAL.	32,272,339	24,519,202	13,795,362		27,498,003	49,270,216		1,362,976	1,350,871	424,787	15,312,735	3,525,423

* Excluding Bengal, for which complete figures are not available except for the four Districts, Darbhangā, Champāran, Muzaffarpur, and Sāran. † Figures are for 1899-1900. ‡ Figures are for 1901-2. § Figures are for 1902-3. ‖ Figures are for 1899-1900. ¶ Mysore, Gwalior, Jaipur, Bīkaner, Jodhpur, Tonk, Alwar, Kishangarh, Bharatpur, Jhālawār, and Kotah.

CHAPTER II

FORESTS

Introduction.

THE forests of the Indian Empire extend between the eighth and thirty-fifth degrees of north latitude, and flourish at elevations varying from sea-level to 12,000 feet and more. Although the changes in the characteristics of the vegetation between these limits must necessarily be of considerable importance, yet those due to differences in latitude alone are not so marked as might be expected from comparison with similar circumstances in Europe, nor is any abrupt demarcation of species apparent. While some trees are characteristic of Southern or Northern India, others are distributed in suitable localities over the whole area of the country; and it becomes evident that the forest vegetation cannot be classified by distance from the equator alone, but that other and more effective influences have to be considered. Of these the principal is the rainfall, which by quantity and distribution, regulated chiefly by the geographical position and physical features of the locality, decides to a great extent the character of the most important forest growths.

Natural classes of forests.

For practical purposes Indian forest tracts may be divided into the following four zones: the Wet with a rainfall of over 75 inches, the Moist with a rainfall of over 50 inches, the Intermediate with a rainfall of over 30 inches, and the Dry with a rainfall under that amount. Within these zones the Evergreen, the Deciduous, and the Dry forests of India may readily be located, while, influenced even to a greater extent by elevation, tides, and inundations than by rainfall, we get Alpine, Tidal, and Riparian forests to complete the classification.

Classification of forests by types.

Of these classes by far the most important, as regards both extent and value, is that comprising the Deciduous forests. From the foot of the Himālayas they extend throughout the length and breadth of the Peninsula, and recur farther east in Burma wherever rainfall and soil is suitable to their growth. They furnish the valuable timbers of sāl, ironwood, teak, red sanders, sandal, rosewood, and ebony, as well as other

important genera, such as *Terminalia, Anogeissus, Acacia, Sterculia, Eugenia*, and *Hardwickia*. Here also are found the Indian padauk (*Acacia Catechu*), noted as yielding 'cutch,' and other trees that supply the wood oils and varnishes so largely used in the domestic life of the inhabitants of the country.

Next in importance to the Deciduous forests must be ranked those thriving in moister climates, and known as Evergreen. These forests occur chiefly on the west coast of India, in Burma, in the Andamans, and to some extent in the sub-Himālayan tracts. Not that all species found in these areas retain their foliage throughout the year; for, as before remarked, the changes in the character of the vegetation are nowhere abrupt, and hence teak, ironwood, *Dipterocarpus*, *Albizzia*, and padauk, with other species, may be found in the Evergreen as well as in the Deciduous forests. Among trees characteristic of the Evergreen forests may be mentioned *Terminalia*, *Cedrela Toona*, the wild mango, *Calophyllum tomentosum*, *Artocarpus*, and species of *Pterocarpus*.

The Dry forests are found in the Punjab and in Central India. Their produce is not of much value. *Acacia*, *Sterculia*, *Butea*, *Terminalia*, *Albizzia*, *Melia*, and *Dalbergia* are all represented, but the trees are mostly stunted or ill-grown.

The Alpine forests of Northern India, Burma, and Assam comprise roughly the tree vegetation between 12,000 and 3,000 feet of elevation; and the sequence of species may approximately be stated as juniper, birch, spruce, fir and cedars, cypress and oak, and rhododendron, while *Pinus longifolia*, and *P. Khasya* farther east, flourish at lower elevations, and finally mix with the Deciduous forests of the plains. In the Alpine forests, in suitable conditions of soil, aspect, and temperature, may be found many trees well known in Europe, such as yew, box, and walnut, while ivy, mistletoe, and roses are abundant.

The Tidal forests occur on those alluvial lands which are subject to overflow of the tide, and are largely represented on the coast of Burma and in the Sundarbans of Bengal, as well as in the northern coast districts of Madras. They contain great store of valuable fuel, and also excellent timber, as represented by the 'sundri' wood of Bengal; while a comparatively new product, the 'Borneo cutch' of commerce—a powerful tanning agent extracted from the bark of several species of mangrove—now adds to their importance.

The Riparian forests of India are typically represented in

the Punjab and in Burma. In the former the principal constituents of these forests consist of *Acacia arabica* and *Tamarix*, interspersed with *Dalbergia Sissoo* and poplar, which, however, gradually give way to scrub and grass as the distance from the water-supply increases. In Burma the forests spring from a muddy soil, which at certain seasons is deeply inundated. Species of *Anogeissus* and *Mangifera* are frequent, while *Eugenia* and *Elaeocarpus* are also found. The forest vegetation merges gradually into that typical of the area affected by tidal influences.

The foregoing description presents a very brief general view of the forests of the Indian Empire. Considered in detail, it will be found that the forest growth is influenced by climate, by aspect, by the composition of the soil, by the depth of the permanent water-supply, and that these influences account for the unexpected appearance of species (covering, it may be, large areas) in zones generally deemed unsuitable to their growth.

Influence of forests on water-supply and climate.

The influence of forests on the climate of the country and the fertility of the soil is of special interest in India. As forests are dependent for existence on water supplied by precipitation, by percolation, or by inundation, so are they locally responsible, in India even more than in the more temperate countries of the West, not only for the storage of rainfall water in the soil, given off subsequently by gentle flow, but also for the supply, by transpiration from the foliage, of moisture to the air. In those vast deciduous forests of Upper India where the leaf flush occurs in the early hot weather, the effect of the rapid unfolding of the new foliage in reducing the temperature is so marked as to be at once perceptible; and indeed these areas continue, so long as the leaves retain their vigour, cooler than the surrounding country. On the other hand, the harmful effects of heavy rainfall in localities denuded of forest growth have necessitated costly works of afforestation even in Europe, while in India, with its heavy tropical downpours, the disastrous consequences are far more serious. The water flows off the bare soil without benefiting the surrounding country, and may cause disastrous floods many miles below; while the change in climate following on the withdrawal of moisture from the air may alter the whole character of the vegetation, and thus annihilate some cultural industry. In short, the forests form the head-works of Nature's irrigation scheme in India; and if these are injured or destroyed, the advantages of a regular water-supply may be replaced by the tempestuous

action of sudden floods until such time as man, with the aid of costly appliances, intervenes to restore equilibrium.

Forests in India have therefore a value to the state far in excess of their mere financial profits. The grazing which they annually afford to countless herds assumes a special value in years of drought, when it renders material assistance in saving from starvation the cattle upon which the agriculture of the country depends. They afford to the villagers who inhabit their vicinity a ready supply of material for house-building and thatching, of fuel, and of minor forest products, which add substantially to the comforts of their life. And the use of forest leaves as manure for the cultivator's fields has already assumed large dimensions, and is steadily spreading as the increasing pressure of population renders agricultural practice more intensive. Enough has been said to emphasize the value of forests, indirectly as regulating the water-supply and moderating the climate; directly as providing those products which in the tropical, sub-tropical, or temperate portions of the country are essential to the welfare of the inhabitants. Of the Indian forests as a source of revenue to the state, as providing timber and other products which are utilized throughout the world, and as, in some cases, creating and maintaining special industries, more will be said hereafter; but it is first desirable to note what extent of forest land is under the direct management of the state, and to judge therefrom to what degree the beneficial influences of forests can affect the country as a whole.

Value of forests to the state.

Statistics compiled in 1901 show that 208,369 square miles may be thus classified, representing nearly 22 per cent. of the total area of British India. At first sight it might be inferred that the proportion between forest and other land had been duly maintained, and this would indeed be the case if the distribution of forest areas were at all uniform. Provincial statistics show, however, that the percentage of forest land varies from 3·86 in the United Provinces to 44·06 in Assam, 61·19 in Burma, and 97·55 in the Andamans; and it may be generally said that the denser the population and the more urgent the demand for the local advantages that forests confer, the less the extent to which these advantages can be enjoyed. The difficulty is one which has been caused by the increase of population and the wasteful practices of former generations. To burn the forest for the welfare of the cattle of nomadic tribes, to clear it for the purpose of temporary tillage, to destroy it for the creation of permanent cultivation, has been the rule

Area of state forests.

in past centuries, and indeed still holds good wherever the Government has not intervened to prohibit such practices. From the distant forests in the far east of India, where wild tribes still practise shifting cultivation, and where the peasant in the more settled lands holds in contempt all timber save that afforded by the 'royal tree' (teak), to the civilized districts of the west where the cultivator and the trader eagerly accept timber of species elsewhere despised; from a density of 6 persons to one of 600 to the square mile—amid these extremes may be noticed the influence of man on the forests of the Empire, and the tardily learned lesson of the necessity of protection.

Departmental classification of forests.

The forests under the direct control of the state are classified as 'Reserved,' 'Protected,' and 'Unclassed' or 'Public' forest land. The Reserves are forests intended to be maintained permanently for the supply of timber, fuel, and other produce, or for the protection of the water-supply or other similar reasons. The Protected forests may be either in a state of transition to Reserves or intended to remain permanently in the second class. In the former case it has been found necessary to prohibit within these areas certain acts harmful to the forest until such time as careful examination permits of a decision whether more stringent rules shall be enforced; in the latter, the object in view has been to provide for the more beneficial exercise of rights by local communities. The Unclassed or Public forest lands are those given over with even fewer restrictions (in some cases to the extent of exemption from the operation of forest law) for the use of the public. Out of the 208,369 square miles under state management in 1901, 88,140 square miles had been reserved, 10,488 were protected, and the remaining 109,741 were unclassed. It will be surmised, and rightly, that the largest area of unclassed forests must occur in those Provinces where the population is scantiest; in fact Burma claims 80 per cent. of the total area under this head, while Assam appropriates the bulk of the balance. In Burma exploration is still incomplete and each year brings an increase of hundreds of square miles to the Reserves; and thus, owing to the fortunate possibility of intervention before the destruction or deterioration of the forest had been accomplished, a forest estate is being built up in that Province which in the future will be unique in organization and value.

To the Indian Forest department is entrusted the duty of carrying out the policy of Government in forest management,

first with a view to the welfare of the country as a whole, secondly for the benefit of the individuals in the more immediate vicinity of the forest, and lastly with the object of utilizing to the utmost such products as the forests supply and thereby increasing the revenues of the state. The creation, growth, and organization of this department will now be briefly described.

Review of forest administration in the past.

At the beginning of the nineteenth century the attention of the British Government was directed to the importance of maintaining the timber supply of the country, but there is no record to show that the value of the forests was recognized save as furnishing sufficient teak for the construction of the fleets or public buildings of the future. Appointed as Conservator of Forests in Malabar in 1806, Captain Watson, during the following fifteen years, protected the teak forests by the method of declaring that timber a Government monopoly. His retirement without a successor was followed by an energetic renewal of those abuses which he had prohibited, and for many years subsequently immense damage was caused by unrestricted felling over large areas. In 1847 Dr. Gibson was appointed Conservator of Forests in Bombay, and nine years later Dr. Cleghorn received a similar appointment in Madras; but although both these officers insisted on the physical value of the forests, and pointed, as results of denudation of the hills, to the silting up of the beds of navigable rivers and the diminution of the water-supply of the country, forest conservancy continued for many years to be regarded mainly as a direct source of revenue to the state. Further east the supply of teak from the forests of Tenasserim had attracted attention as early as 1827, but here also many years elapsed before efficient measures were taken to protect the timber resources of the country against the recklessness of irresponsible contractors. The annexation of Pegu in 1852 opened a new field for the spoliation of Government forests by private individuals, but this was happily checked when three years later Lord Dalhousie inaugurated a permanent forest policy.

Organization of the Forest service.

In 1856 Dr. (now Sir) Dietrich Brandis was summoned from Germany to be Superintendent of Forests in Pegu. He remained in Burma till 1862, engaged in organizing forest management in that Province; and, after having been placed on special duty to perform the same work in other parts of India, he was in 1864 selected to be the first Inspector-General of Forests to the Government of India, a post he retained for nineteen years. To him and to his successors

and pupils, Messrs. Schlich and Ribbentrop, is due primarily the credit for the creation and organization of the Forest department, and for the introduction of methods of management adapted from the best European schools to suit the varied circumstances of the vast forests of India.

The first Inspector-General of Forests found himself for some time without an organized controlling or executive staff, for no trained officers were available and those already in the Forest service had been selected from other departments. It was not until 1869 that the first graded list of the Indian Forest service was published, containing the names of 57 officers, with aggregate salaries of about Rs. 95,000 per annum.

The increase in the operations of the department since that date may to some extent be gauged by the increase in establishment, which will ultimately comprise an Imperial and a Provincial service, with a staff of 175 and 134 officers respectively, having under their orders a body of 14,824 subordinates, of whom 10,465 are permanently and the remainder temporarily employed. This forest staff draws in salaries an annual sum amounting to nearly 45 lakhs of rupees.

Subject to the general supervision of the Government of India, the control of Forest administration rests in each Province with the Local Government, which holds the Forest Conservator responsible not only for the proper application of the correct principles of forestry suitable to the conditions of the Province, but also for the departmental and financial management of his Circle. This responsibility is defined in the lower grades by the formation of Divisions, corresponding as far as may be to revenue Districts and held in charge by officers of the Imperial or Provincial services; and of Ranges and Beats in charge of members of the Subordinate service. Forest operations are, however, subject to the control of the local executive officers (Collectors, &c.), in matters which directly affect the people, such as the reservation of grazing, the levy of grazing fees, the supply of minor forest products, and the like.

Recruitment and technical education.

The officers of the Imperial service are recruited in England, where, after passing a competitive examination, they receive a technical education extending over nearly three years, the forestry course at the Royal Indian Engineering College, Cooper's Hill[1], being supplemented by extensive tours and some months' residence in typical continental forests. The recruitment of the Provincial service is effected from among

[1] See appendix at end of chapter.

those members of the Subordinate service who have obtained the higher certificate of the Imperial Forest School at Dehra Dūn; while the members of the Subordinate service are appointed by Divisional Forest Officers, who are held responsible that suitable men possessing a fair elementary education are selected, in the first instance, for forest guards.

In addition to the Forest School at Dehra Dūn, an institution established in 1878 which annually receives over fifty pupils, opportunities for the acquisition of a forest education are afforded by the Government at Poona in the Bombay Presidency; and in Burma, where special difficulties exist, a secondary school has of late years been opened. At these institutions all students are provided with a technical education, free of cost, by the state, while members of the Forest service under training receive the pay and allowances of their grade; and thus every inducement is offered for the acquisition of a knowledge of practical forestry by the natives of the country. At the same time a forest education in English is now much more readily obtained than was the case some years ago, for works on Indian botany, engineering, forestry, sylviculture, and other sciences intimately connected therewith, have from time to time been published by the officers of the Forest service.

Employment of Indian Forest officers outside India.

It is not therefore surprising that the officers of the department, provided with an excellent technical education and fortified with the varied experience that service in India supplies, should be in demand to conduct the management of forests in other parts of the world or to report on the best system for their organization. In Cape Colony, in Uganda, in the Sūdān, in Nigeria, and in Siam, Forest officers supplied by the Indian Government are now applying the lessons learnt in the jungles of India; in the Straits Settlements, in Mauritius, Cyprus, Ceylon, the West Indies, and elsewhere advice has been given or organization effected by the same agency; while the forests of the more important Native States are often managed by officers deputed from the department or trained in the Forest schools of the country. The forests of the Indian Empire have also been visited, and the methods applied in them professionally studied, by officials from France, Germany, Japan, and other countries.

Indian forest law.

The basis on which Indian forest law proceeds is that all uncultivated tracts in which private rights have not been acquired, either by the individual or by a local community, are the property of the state. The position of the Government as

owner of forest lands carries with it great responsibilities, and it was soon recognized that unless these areas were brought under some control they would in many cases be so diminished or ruined by wasteful use as to become incapable of supplying the legitimate demands of the population for timber and other products. In fact, with the growth of population, it became impossible to continue the ancient system by which each man took from the jungle all that he required to a great extent without supervision, and in many cases free of charge. On the other hand, the areas over which the state claimed proprietary rights, and the extent to which such rights required to be tempered by the recognition of local claims and usages, needed to be defined; there was no adequate machinery by which the settlement or reservation of forest areas could be carried out or control assumed over their management; and thus the necessity for forest legislation became apparent. The first Indian Forest Act was passed in 1865, and under its authority a large number of local rules were issued in the Central Provinces, the Punjab, Burma, Berār, Coorg, and the United Provinces. Although defective in many respects, this Act remained in force till 1878, when it was replaced by the Forest Act of that year (Act VII of 1878), which extended to all parts of British India save Madras, Burma, and a few minor Administrations. In 1881 a Forest Act was passed for Lower Burma, and in 1887 a Forest Regulation for Upper Burma, then newly annexed; these two Acts have been amalgamated in the Burma Forest Act of 1902. In 1882 the Madras Forest Act was passed, and between that date and 1891 those Provinces to which Act VII of 1878 did not extend received by separate legislation the benefits of forest law.

Steps by which state forests are constituted.

The first step in applying this law was to discriminate between: (1) forest lands absolutely the property of Government; (2) forests which were state property but burdened with private rights; and (3) forests which were the property of private individuals or communities, but over which it was expedient to exercise a measure of control. It then became necessary to define the limits of the areas to be controlled, and to prepare, where necessary, a settlement record to prevent subsequent encroachment, illegal utilization, or the growth of new rights. The classification of forests into Reserved, Protected, and Unclassed has already been noticed. In those areas to which Act VII of 1878 extends, two classes only of forest are recognized, the Reserved and Protected; and in Unclassed

forests no forest law is operative. In the Madras and Burma Acts, on the other hand, only one class of permanent state forest, the Reserved, is specially dealt with, but power is taken to extend a certain amount of legal protection to all other forest lands.

When it is desired to create a Forest Reserve, three months' notice of the intention is given to all likely to be interested in the proceedings, and after the expiry of that period a local inquiry is instituted by a specially deputed Revenue official, styled the Forest Settlement Officer, who is usually accompanied by an officer of the Forest department. All claims advanced for exercise of rights within the area to be reserved are duly considered, and if acknowledged are recorded in detail in the manner prescribed by law. The Forest Settlement Officer can recommend but not finally record privileges. These require the sanction of Government, for among them is included a practice most destructive to forest growth, that of shifting cultivation, which is still permitted over large areas to the descendants of those who for centuries have existed by means of this thriftless agriculture. After the settlement record is complete, a period for the presentation of appeals to a competent court follows; and when these have been decided and recognized, when local rights have been confirmed or bought up, there remains nothing but the sanction of the Local Government to constitute the Forest Reserve. For the creation of Protected Forests a somewhat similar procedure, but in much simpler form, is adopted. Such inquiry as may be considered adequate is made, and rights may be recorded or regulated, but the record so compiled is not deemed to be conclusive. The main essential in both cases is that all interested shall have an opportunity of advancing their claims; that these claims should be fully considered in an impartial court; and in the case of Reserves, that the record shall be in such detail that the demands on the forest shall be absolutely defined, and that the settlement, once completed, shall be final. The regulations for Unclassed Forest lands are usually framed with a view to permitting free, but not wasteful, utilization of produce for domestic use, and to taxing, by the imposition of a royalty, all articles removed for trade purposes; and by this means the people dwelling in the vicinity of the forest benefit, while a considerable revenue is collected for the state.

After constitution of the forest estate, the duties of the Forest officer commence with the protection and improve- Demarcation.

ment of the areas brought under his management. In the first place, permanent demarcation must be effected for the prevention of encroachment or trespass, and the method in which this is carried out varies with the value and position of the forest. In Provinces where these are a source of important revenue, and where the pressure of population is marked, more expenditure can be legitimately sanctioned than in areas differently circumstanced. All methods, however, agree in the two details of numbering the boundary marks and of constructing a footpath between them. The cost of new demarcation work and repairs to former boundaries amounted in 1901 to Rs. 1,11,000.

Surveys.

Following on demarcation comes the detailed survey of the forest area. It was found in the early days of forest organization that the maps then available were too small in scale, and possessed too little topographical detail, to be of much use in forest work, and in 1872 a special agency was created in the Forest Survey Branch which was under the control of the Inspector-General of Forests until its absorption in 1899 into the Survey of India. The maps now issued for the use of the department can hardly be surpassed in accuracy, in topographical detail, and in the amount of information they afford: there appears to be nothing from classification of forest growth to the depth of the permanent water-supply that cannot be recorded if timely application be made to the Survey officer.

Working-plans.

When it becomes desirable to control the working of a forest, to regulate its out-turn, and to provide for the yield of the future, a report is drawn up, and generally forwarded to the Inspector-General of Forests, which describes the area, the vegetation, and the past management, and contains proposals for a fixed and amended management in the future. The Provincial Government then deputes an officer who, after thorough inquiry into the condition of the forest, the prospects of reproduction and improvement, the facilities for export, and the demand for the produce, compiles a 'working-plan.' This plan regulates the amount and removal of out-turn, and prescribes the other requisite operations, such as sowing, planting, thinning, and cleaning. The measures necessary to ensure protection from fire or cattle are also detailed; and the construction of roads, bridges, and buildings is systematically prescribed. Working-plans are generally compiled for periods of twenty to forty years, after which revision, or possibly the introduction of an entirely new system of management, will be necessary. The

latest available statistics show that 22,679 square miles, or a little over one-fourth of the area of Reserved forests, are worked under regular plans.

Communications and buildings.

In regard to the improvement of communications for the purpose of export, much has been accomplished since the organization of the department. The expenditure necessary under this head varies enormously with the physical configuration of the country. In the hills the construction of timber slides or road-making must always be costly; less so in the plains, where, however, the building of tramways or narrow gauge railways is sometimes justified by the promise of a regularly sustained out-turn. In some Provinces, such as Assam, Bengal, and Burma, forest produce is conveyed along the magnificent river waterways which Nature provides, and in Burma the Forest officer has to pay special attention to the utilization of the feeders of the main rivers as floating-streams. The protection of the forest staff against the inclemencies of the climate by the provision of suitable rest-houses has also received attention. The expenditure on communications and buildings amounted in 1901 to Rs. 4,64,000.

Protection from man.

Statistics setting forth the results of the application of forest law and regulations are interesting, as showing the protection these afford against petty depredations or more serious attempts to injure or appropriate state property. In 1900 the Forest cases decided by Magistrates numbered 11,270, of which nearly 87 per cent. resulted in convictions. The majority of cases are, however, not brought into the courts at all, the Forest officers being empowered to compound minor delinquencies for cash payments if the offenders so desire—32,803 cases were so disposed of in 1900. Taking prosecution and compounded cases together, about 26,000 referred to illegal felling of timber or removal of produce, 17,000 to illicit grazing, and the remainder to injury by fire or other offences. The number of reported cases in which the offenders remained undetected amounted to over 6,000, of which one-third were on account of injury to the forests from fire, an offence the most necessary to punish but the most difficult to prove. Considering the extent of the Indian forests and the ease of evading detection, it may be said that the commission of only one offence annually in each four square miles of area goes to prove that forest law does not press hardly on the people.

Protection from fire.

The protection of the forest area from fire is one of the most important and arduous duties of the Forest officer. It is true that in these days he has not to contend against the belief that

fire is not harmful to forest growth: that in spite of its yearly recurrence the forest will still flourish. Such opinions had necessarily to give way when the opportunity occurred for comparison between similar forests in adjacent areas, protected and unprotected. It is at the present time agreed that, if a soil suited to the maintenance and improvement of the forest is required, and also reproductive growth sufficient to assure a full and regular out-turn, it becomes indispensable to protect the forest from the effects of fire, and that if this is not successfully accomplished other efforts towards improvement will have little result. But in carrying out this policy of protection the difficulty arises that the customs of the country are in direct opposition to it. From time immemorial fire has been, in the hands of uncivilized man, the most powerful agent in destroying the permanent vegetation of the country with a view to obtaining more readily food for himself and his cattle; and even in those areas where there is no necessity to continue the struggle with the exhausted forest, this ancestral weapon is still employed, though it be but to clear a few acres of waste or to isolate an insignificant patch of shifting cultivation, at the risk of destroying the adjoining forests. Only after the mischief has been done is it realized that the forests have been unnecessarily sacrificed to accomplish a result that a few hours' mechanical labour and a little care would equally well have brought about. The Indian forester has therefore to contend not only against accidents as understood in civilized countries, but also against the thoughtlessness and ignorance of the people; he has to uproot old and introduce new habits, and his efforts in this direction must be gradual and adapted to the slow absorption of novel ideas by the peasantry of the East. On the other hand he has rarely to combat popular ill-will. Incendiarism is uncommon, and when it occurs may often be traced to some petty malice against an individual or community. The system of fire-protection may be described generally as consisting in the isolation of the protected area by removing all inflammable material from the vicinity of its boundary, and in regulating the kindling of fire in its neighbourhood; and this is effected by means of fire-lines on which all vegetation is cut and burnt, combined with the enforcement of simple rules by means of a staff of patrols who prevent, save under certain restrictions, the kindling or carrying of fire. Meanwhile, inside the Reserve, other fire-lines have been prepared with a view to localizing any conflagration that, in spite of all precautions, may cross the boundary or may be produced

wilfully or by accident within the forest; such lines are designed with a view to form bases for counterfiring, or in more moderate climates to permit of other methods of controlling the flames. Fire conservancy operations in British India extended in 1901 over 34,000 square miles and involved an outlay of Rs. 12 per square mile. The extension of fire conservancy is hampered not by financial reasons, for the outlay has been small in proportion to the value of the property insured, but by the local difficulties of the work and the necessity for an executive staff numerically and physically strong enough to carry out successfully this arduous duty. At present, having in view the large areas of valuable Reserves still unprotected, no effort has been made for the welfare of the Unclassed forests; but the day cannot be very far distant when, as already foreshadowed by the action of the owners of private forests, all those to whom the utilization of forest produce is of importance will, from motives of self-interest, unite in its protection.

Protection from cattle.

The protection of the forests from cattle is a matter of less difficulty though hardly of less importance. As a rule the residents in forest districts have been liberally provided with pasturage in state forests, in some cases to such an extent as to make the production of timber a matter of secondary importance. Much of the trouble caused by cattle trespass may be traced not to the agricultural but to the pastoral classes, who find their operations restricted by the increase of cultivation and by the forest conservancy that naturally follows such increase. It is of course admitted that grazing is inimical, and browsing fatal, to forest regeneration; that one and the same area cannot at the same time provide unrestricted grazing and a normal out-turn in timber. If therefore the forest is managed for the benefit of the people, it is necessary to decide whether they require grazing or timber, or if both, then in what proportions. As a rule such questions are settled by the alternate and periodical opening and closure to cattle of fixed areas; otherwise separate tracts must be permanently allotted for the supply of timber and of pasture. In this regard the vital necessity of detailed definitions in the settlement record is indicated, for generosity in forest grants that extends beyond the capabilities of the forests readily defeats its own object by imposing on the forest capital a tax which should be levied only from its annual yield. The regulation of grazing has, more even than fire conservancy, an influence in preventing the denudation of hill slopes and catchment basins. It is

probable, however, that the burden necessarily imposed on state forests in the matter of grazing will hereafter rather diminish than increase, for forest grazing is ill adapted to the maintenance of valuable cattle or to the improvement or purity of any special breed. It may therefore be that in course of time the demand for pasturage will be converted into a demand for fodder, not only to the benefit of the cattle, but with a resulting increase of out-turn in both grass and timber from the forest. The area closed to grazing amounted in 1901 to 35,000 square miles, of which nearly 15,000 square miles were in Burma, where cattle are few and vast tracts of waste land are still available outside Reserves. The area closed to browsers, principally goats, amounted to 33,000 square miles, situated chiefly in Madras and the Central Provinces. The value of pasturage granted free or at reduced rates during the year is estimated at Rs. 11,00,000. It should be noted that in times of famine the ordinary restrictions on grazing are often relaxed.

Natural regeneration.

By far the largest portion of the Deciduous forests in India was, when taken over by the Forest department, in a ruined condition, for not only had the sound mature timber of the more valuable kinds been extracted, but the younger growth had been so maltreated by axe and fire as to be unfit to provide a reliable crop in the future. In these circumstances the removal of existing stock as speedily as might be consistent with the prevention of soil deterioration was the task set before the forester, who was, moreover, responsible that his efforts should result in the reproduction of a healthy growth: these conditions explain the prescription of improvement fellings so frequent in the earlier working-plans. These operations varied necessarily in intensity and method with the circumstances of each individual case, but always had the object of increasing the productive power of the soil by adequate protection, while replacing the injured and useless stock with a healthy growth. The labours of the forester were, however, far from complete when this preliminary treatment had been successfully carried out. It was, it is true, subsequently easy to regulate the out-turn by limiting future selection-fellings by quantity, by area, or by both; but of the numerous species composing the forest only a few are valuable, and in order to derive a full yield from these, while stimulating their production at the expense of the less valuable trees, the most careful treatment is constantly necessary. This is the case not only in the ruined forests which have passed through a preliminary treatment, but also in those where adverse influences have not sufficed to injure the growing

stock to any serious extent. The difficulty here indicated is further emphasized by the fact that the exercise of local rights and grants of free produce frequently cause an almost total absence of demand in the neighbourhood for timber of the inferior kinds, so that the removal of such trees becomes a source of expenditure instead of profit. Nor do these drawbacks cease when the forest has been brought into that condition where the most desirable species are well represented in number and quality, for the pressure of the numerically stronger, and probably quicker-growing, inferior species still continues to be felt and to require the interference of the forester. The natural regeneration of the valuable teak forests in some parts of India is for these reasons a difficult matter to promote, in spite of the experience that the study of years has brought. Even less is known of the production of padauk and ironwood; in fact, in most cases where the species in demand are scattered throughout a mixed forest of which they form but a small proportion, though much has been learned more yet remains to be ascertained. As a general rule, in such circumstances, the principal fellings may be preceded, accompanied, or supplemented by other operations, having in view both the girdling and removal of inferior trees and the diminution of the under-growth, in order, by the admission of light, to permit of the germination and continuance of seedlings of the more important species. Although the cost of these operations, and the necessity for carrying them on under the strictest supervision, limit their extension, they have in many instances been successfully accomplished. In the sāl forests this has been the case in a most marked manner, due possibly not only to the fact that this tree forms a larger percentage of the total forest stock than the teak, but also that it responds more readily to the advantages of protection than the other species with which it is associated. In the Alpine forests such aid to natural reproduction is not usually required, as this follows as a general rule with certainty on adequate conservancy and judicious treatment of the canopy. But though it is necessary to rely almost entirely on natural reproduction in order to maintain the forest stock, occasions arise when Nature can be assisted, not only in the preparation of a suitable seed-bed, but also in conveying seed to the desired locality. The broadcast sowings on barren hill slopes in Bombay, the dibbling of teak and cutch seed in Burma in areas where flowering bamboos have been cleared by fire, are instances in point.

Of natural reproduction by means of coppice growth there are

many excellent examples to be found in India, chiefly in those districts where the demand for small timber and fuel is intense, but also on areas where the local conditions are unfavourable to the growth of large trees. In such forests it is usual to retain a certain number of seed-bearers of the more important species, so that natural seedlings may aid in the regeneration of the forest. The financial return under this system of management is often very high.

Cultural operations.

The operations undertaken for the good of the growing stock, in addition to felling and girdling, are chiefly confined to climber-cutting and thinning or weeding. The latter serves to remove such stems as may be interfering with the more valuable immature trees and, as this requires constant professional supervision, can be carried out only over limited areas. The cutting of climbers and killing of epiphytes may, on the other hand, be mechanically performed by members of the protective staff, and in consequence large areas are yearly treated for the destruction of these pests. Thinnings and weedings in natural forests are not generally carried out as a separate work; they progress side by side with other cultural operations and are included in their cost.

Artificial reproduction.

Artificial plantations in the forests of India extend over 102,000 acres. One-half of this area is situated in Burma and one-third in Madras, the remainder being distributed in comparatively small patches throughout the other Provinces. Teak, sissū, catechu, casuarina, eucalyptus, rubber, and deodār are the principal species cultivated. The oldest teak plantation is that at Nilambūr in the Malabar District of the Madras Presidency. Started in 1842, it has already repaid its original cost and is expected to yield a large income in the future. The plantations in Burma consist chiefly of those described as 'taungya,' where the practice of shifting cultivation is permitted provided that teak is sown with the field crop. This system was adapted to the customs of the country, and a large area has thus been stocked with this valuable species. The advisability of supplementing the supply of rubber from natural forests by creating plantations has not been lost sight of. For the past thirty years there has been an important rubber plantation in Assam, while from experience gained there and in smaller experimental gardens elsewhere it has been decided to extend systematically rubber planting in Burma on a large scale. The expenditure on plantations in 1901 amounted to Rs. 1,30,000. Although the areas under artificial reproduction can represent only an insignificant proportion of the vast

forests of India, yet in cases where it may be requisite to restock speedily denuded tracts, to provide for pressing requirements in some special forest product, to utilize waste lands, or to extend the area under some valuable species, these operations are often necessary and, at the same time, remunerative.

The out-turn from the forests of India is for the sake of convenience generally classified under Timber, including fuel; Bamboos; and Minor Produce, including grass and grazing, besides all those numerous products found or manufactured in a forest. Of the timbers the most important are teak, deodār, sāl, sissu, ebony and rosewood, blackwood, cutch, sandal, babūl, red sanders, ironwood, and padauk. There are hundreds of other species possessing admirable technical qualities; but few of these have any value save for local consumption, being as yet unrecognized by trade, or not occurring in sufficient quantities to secure for them a permanent footing in industries that could utilize them. The total out-turn of timber and fuel from state forests amounted in 1901 to 232,000,000 cubic feet; the average out-turn per square mile varies considerably in the different Provinces, being dependent on the intensity of working and the density of the population. Over 3,500,000 cubic feet of teak, valued at Rs. 87,00,000, were exported during the year to foreign countries, whither sandal, ebony, and other ornamental woods were also sent to the value of Rs. 10,70,000. The yield of bamboos numbered 185,000,000; of these about one-third were supplied by Burma—Bengal, Assam, and the Central Provinces coming next on the list. The yield of minor produce from state forests was valued in 1901 at nearly 50 lakhs of rupees, the chief items being grazing and grass, caoutchouc, lac and dyes, cutch and gambier, cardamoms, myrabolams and other tanning material. The minor forest produce exported from India during the same period represented a value of 175 lakhs, derived probably to the extent of two-thirds or more from forests not under state management.

Yield of the forests.

Inquiries instituted into the economic possibilities of Indian forests are gradually bringing to notice the value of new products and directing attention to others heretofore only locally utilized; while the efforts made towards the improvement and protection of the forests are resulting in a larger out-turn of those products for which there is already an assured market. The importance of the Indian forests from an economical point of view must primarily depend on the demand for their yield in India. Thus, increased prosperity among the rural population, or the establishment of new industries, is

always accompanied by an increase in forest revenue; and it is only when the forest yield is in excess of local requirements or, for special reasons, commands abroad a higher price than is justified by its local importance, that the unutilized balance is made available for export. For these reasons the valuable timbers of the red padauk and teak are now only sparingly used by the inhabitants of the country, while various articles of minor forest produce, such as lac, silk, wax, tanning materials, catechu, wood, oil and varnishes, and resin, which are produced in excess of the local demand, form important items in the trade returns with foreign countries. With regard to these by-products of the forest it appears probable that the full yield is seldom used to advantage save in areas under carefully regulated management. Where the population is dense and utilization of the forest unrestricted a sustained yield becomes impossible. Where, on the other hand, the population is scanty compared with the extent of the forest, the inhabitants are unable to reap fully the scattered crop which lies at their disposal. It thus becomes evident that both the economic value and the yield of Indian forests must at first increase with the increase of population, while ultimately the restriction of the forest area consequent on the spread of cultivation must be counterbalanced by ever-increasing forethought in the management of those areas which are permanently set aside by the state or by private owners for the supply of forest produce. In this way alone can the economic value of the Indian forests be maintained, first with the object of satisfying the growing needs of the people, and thereafter with a view to the commercial advantages which must result from regulated protection and exploitation.

Methods of exploitation.

The methods of exploitation are ruled by the requirements of the different Provinces, and a broad classification under the heads of removal by Government agency, by purchasers, and by right-holders, is generally found to give sufficient detail combined with desirable simplicity. The regulation of the out-turn by means of working-plans has already been described, and those forests as yet not specially provided for by these schemes are controlled by means of annual plans of operations, which, among other details, fix the method of exploitation. But this regular system is only of comparatively recent introduction. In former times, in the absence of departmental organization, the forests were opened to private traders who neither attended to the future welfare of the forests nor afforded to the state an adequate return for the produce extracted. In

the hill forests of the Punjab, in Burma, and in parts of the Central and United Provinces the ill effects of this system may still be traced. Government agency in exploitation is at present chiefly confined to controlling the removal of produce by contractors from the forests to the place of sale; but, though to a less degree than formerly, it is still sometimes necessary that the Forest department should set an example in inaugurating some new industry, should undertake the construction and working of tramways and timber slides, or arrange for the direct supply of timber or fuel. Removals by Government agency in 1901 comprised 10 per cent. of the total extractions of timber and fuel, 1 per cent. of the out-turn in bamboos, and 4·4 per cent. of that of minor produce.

The removal of timber by purchasers is also regulated in various ways adapted to the customs of the country. In the case of large purchasers (such as the Bombay-Burma Trading Corporation in Burma) whose trade is dependent on the supply of mature timber, permission to fell and remove trees of the more valuable kinds is granted under the conditions of a contract that provides for the payment of royalty at fixed revenue stations; in the case of smaller purchasers of the less important kinds of timber, felling and removal is allowed under the authority of a pass or licence, the cost of the produce being generally paid in part at the time of its issue. Both these systems, though not affording an ideal degree of protection, are suited to the requirements of the trade and to the amount of supervision available, and special care is taken in checking the removal of the more valuable timber. As regards the collection of minor forest produce, a similar system of passes is adopted, or the productive areas are leased, or personal collecting licences are issued for a fixed period. The collection of grazing dues is often made through the agency of the Land Revenue department, sometimes also by the Forest officer.

The measure of control exercised over the enjoyment of free grants by right-holders depends almost entirely on the demands upon the forest. In some Provinces those so privileged have up to the present seldom exercised their full rights in Reserves, having ample provision for their needs in the adjoining Unclassed areas; in others the greatest care is necessary to prevent excessive removals of timber from a forest taxed perhaps to the full extent of its yield. Between these two extreme cases the necessity of restrictive rules is determined in the one case registers and permits are not called for, in the other, care is required in their upkeep or issue. It is, however,

impossible to give briefly any but the faintest outline of the schemes for regulating the exploitation of timber and produce throughout India, for they differ in each Province and are controlled by a multiplicity of rules adapted to the customs of the inhabitants.

Financial results.

The direct value of forests to the state may be gauged by the financial results of their working. In 1901 the gross revenue collected through the agency of the department amounted to Rs. 1,97,70,000, and the value of grants to right-holders and others was estimated at Rs. 33,10,000. More than 40 per cent. of the total revenue is derived from Burma, while next in importance in this respect come the forests of Bombay and Madras. The sale of timber and fuel produced Rs. 1,47,00,000, minor produce Rs. 29,00,000, and receipts from grazing Rs. 12,00,000. The steady improvement in forest revenue is worthy of note: between 1864 and 1867 it averaged Rs. 36,29,000; by 1887 the quinquennial average had risen to Rs. 1,10,59,000, and by 1897 to Rs. 1,74,50,000. During the same periods the expenditure had increased from Rs. 13,99,000 to Rs. 71,42,000 and Rs. 96,57,000 respectively, while in 1901 it amounted to Rs. 1,11,60,000. The proportion of expenditure to gross revenue is now about 57 per cent.; and of this nearly 26 per cent. is spent on administration, 28 per cent. on working, protection, and improvement, while the remainder represents capital expenditure upon the constitution of new Reserves by settlement and upon their demarcation and survey.

The net revenue of the Indian forests has between 1865 and 1901 risen from Rs. 14,00,000 to Rs. 86,00,000; and the yield of the state forests will, as the result of protection and improvement, be more than sufficient to meet increased demands on their produce hereafter.

Free grants of forest produce.

In comparing the Government receipts from Indian forests with the gross out-turn and the total exports, it has to be remembered that timber and other produce from state forests is given free (or at reduced rates) in large quantities to the people resident in the vicinity. In 1901 the value of these grants amounted, at a very low estimate, to about 16 per cent. of the gross revenue collected in the state forests, while the enormous quantities of timber and produce removed free of royalty from Unclassed forest land have further to be taken into consideration. It has also to be borne in mind that there are in India immense forest areas outside the direct control of the British Government, being the property of Native States or of private individuals. The statistics regarding these forests are

difficult to obtain, as in many cases the areas are unsurveyed or their administration is not separately controlled, but the following details are of interest.

Taking first the most important Native States, where a more or less complete system of forest management has been introduced, the following may be mentioned :— Native State and private forests.

Hyderābād possesses an area of about 5,000 square miles of State forests, which produced in 1900 a revenue of about Rs. 2,80,000, against an expenditure of one-half that amount. These results will probably be much improved when the forests are demarcated and settled; at present there is much to be done in these directions.

Mysore possesses about 2,000 square miles of Reserves, with a gross revenue in 1900 of about 13½ lakhs and a net revenue of nearly 9 lakhs. Nearly three-fourths of the revenue is derived from the sale of sandal wood. Fire-protection extends over 1,500 square miles.

Kashmīr has 2,180 square miles of settled State forests where fire-protection is well established. The revenue in 1901 amounted to Rs. 8,80,000, with an expenditure of Rs. 5,80,000.

Jodhpur, on a forest area of 343 square miles, collected in 1901 a revenue of about Rs. 20,000 and expended nearly the same amount.

Travancore has 1,800 square miles of Reserves, nearly all being fire-protected. The revenue in 1901 was about 5½ lakhs and the expenditure a little in excess of 2 lakhs.

Besides these States there are others of less importance that possess large forest areas amounting on a very rough estimate to about 42,000 square miles; while the forests owned by private individuals in the British Provinces are supposed to extend to at least 77,000 square miles. Not that the whole of these areas are covered with tree growth. Some contain merely scrub jungle on hill slopes; in others the principal yield is grass or some other minor product. But there are also tracts carrying valuable timber; and as there is, ordinarily speaking, no state interference with private forests, and no special law for their protection, it depends on the owners whether they are treated rationally, with a knowledge of their influence on the welfare of the people and the future income from the estate, or regarded merely as a source of immediate wealth to the individual possessor. The latter case is gradually becoming more rare; the example set by the Government of India, in regulating the management of state forests, and the results of that management in increasing the prosperity of the country and its

revenues, are too manifest to be overlooked. The advantages of forest conservancy are accordingly now being recognized not only by the more enlightened Indian princes but by private proprietors throughout the country.

Forest tribes; their general economic condition.

The foregoing paragraphs present a brief account of the creation and management of the state forests of India, but afford no insight into the conditions that have in the past regulated progress in these respects. In the creation of state forests the forester, first as an explorer and then as a pioneer, finds his sphere of action in advance of the wave of civilization caused by increased prosperity in the more settled lands. In his preparations for the requirements of the future he comes in contact with forest tribes who, whether timid or ferocious, simple or cunning, all possess the common characteristic of viewing with intense jealousy any interference with the habits and customs of their primitive life. To them, though perhaps they only dimly realize it, the advance of civilization must mean either extinction or absorption into a population possessing a stronger vitality. The policy of the Government of India is to permit no sudden imposition of restrictions that may alter the accustomed mode of life of these tribes, but rather to win confidence by kindness, and thus gradually to create self-supporting communities, acknowledging the state as arbitrator of those questions hitherto decided by might rather than by justice. It is on the manner of giving effect to this policy that the success of the inauguration of forest conservancy often depends; for here, even more than in the comparatively civilized parts of the Empire, the work of the Forest department can only commence with the acquiescence of the inhabitants, and only progress with their assistance.

With very few exceptions all forest tribes depend to a certain extent on agriculture to supplement their food supply, even though hunting, fishing, and the collection of forest products may form the most important part of their occupation. Most of them are nomadic of necessity; they move in quest of game and practise shifting cultivation at their temporary head-quarters; all are armed with the best weapons they can manufacture or procure; and as a rule tattooing in red or blue, or other methods of permanently impressing the tribal marks on the skin, are largely resorted to. It is evident that, with the restriction of the large areas over which these tribes are wont to roam, and the resulting diminution in the supply of food that the forests can afford, the formation of village communities possessing permanent cultivation must gradually ensue; and though in

the first instance such villages are self-supporting even to the smallest detail of domestic requirements, yet in time many savage customs and arts no longer necessary in a settled life will entirely disappear.

Typical tribes.

Probably the most primitive of all forest tribes are the Jarawas of the Andaman Islands. They are true forest folk, who never leave the deep shade of the evergreen forest and subsist solely on the vegetation and animal life around them. Totally ignorant of agriculture, they have only recently made acquaintance with the value of metals and are now ready to take life, or to risk their own, in order to acquire an iron implement which shall make its possessor superior to his fellows. With them it has hitherto been impossible to open up friendly relations, and the armed escort that must accompany the workers in their forests is not always successful in protecting men and elephants from their arrows.

Numerous tribes, such as the Chins and Nāgās, still exist in the wild hill forests of Burma and Assam, who though warriors and hunters yet have permanent villages, more useful as tribal strongholds than as centres of agriculture. It is but a few years since entry into their territory meant death or slavery, and still more recently their well-organized raids were a terror to the surrounding country. To-day they are gradually renouncing their savage life; for a knowledge of the power to punish followed by confidence, first in the individual and then in the Government, works wonders even in a single generation.

More directly under these restraining influences are the Kachins and Karens of Burma. The former possess no written language, they are worshippers of demons with whom imagination thickly peoples the forests, hospitable but revengeful and unforgiving, and delighting in the most persistent blood feuds; the latter are more advanced, reserved, and suspicious, yet mixing with the people around them and tending largely to Christianity in the place of a lost religion. Both practise shifting cultivation; both are hunters who also hold human life of small account.

Other tribes, less in number and of smaller importance either politically or to the Forest officer, are found surviving in almost every Province in India. Under a less gentle rule they would long ago have disappeared; at the present time their protection and maintenance is often a first charge on the forest estate of the Empire, and in many localities the extension of forests and their management must continue to depend to some extent on the treatment and requirements of these jungle dwellers.

Employment of animals as carriers of forest produce; elephants.

In the successful management of the forests one of the most important details is the method by which the produce can be extracted and conveyed to a profitable market. However excellent the main system of communications may be, there yet remains the problem of bringing timber or other material from the forest to the road, railway, or river that leads to the place of utilization. In very few cases can the use of costly appliances be justified in the extraction of a widely scattered crop, and hence the large employment of bullocks, buffaloes, and elephants in forest operations, not only in wheeled traffic but also by the more interesting method of carrying or dragging. In some parts of India the extraction of produce is almost entirely dependent on the aid of bullocks and buffaloes, and long files of these animals, under the control of wild Banjārās or Muhammadans, may be met on forest paths laden with bamboos or scantlings; in others cattle are yoked to larger timber and drag it by sheer strength to the desired locality. Farther east the employment of elephants in the working of large timber is almost universal. Here heavy logs of from 2 to 6 tons are dragged to those creeks where good floods may be expected in the monsoon months, and are thence attended in their passage to the main river by elephants, who push the stranded timber into the stream, or, at the peril of their lives, relieve a 'jam' in some dangerous turn. The work of these sagacious animals does not, however, end in the forest; for on the arrival, perhaps after many months of adventure, of the timber rafts at the sale dépôt the elephant is again ready to drag the logs from the water, and is responsible for the methodical arrangement of the various lots, for piling the heavy timber of the reserve stock, and for the accurate stacking of the sawn scantlings. It is not surprising that the value of these intelligent and willing animals should have increased with the extension of forest operations. Their price has in fact more than doubled during the past few years; and the protection of the wild herds against the hunter, and the introduction of 'kheddas,' have become necessary if the supply of these valuable workers is to be maintained. Without elephants it would, under present circumstances, be impossible to meet the demand for teak timber throughout the world. Later on they too will disappear, for the conditions of forestry in India are undergoing the most rapid changes, and when man interferes to assign the limits of the forest and regulate its growth he interferes also with the freedom so essential to the existence of its former inhabitants.

APPENDIX

Since the closing of the Royal Indian Engineering College, Cooper's Hill, at the end of the session in 1906, probationers for the Indian Forest Service are appointed by the Secretary of State upon the results of a competitive examination conducted by the Civil Service Commissioners. The period of probation extends over three years, two of which are spent at Oxford and the third on the Continent. Those who pass through the course satisfactorily receive the diploma of forestry from the University of Oxford, and it is expected of them that they should also obtain a degree in the Honour School of Natural Science. They are then appointed Assistant Conservators in the Indian Forest department.

BIBLIOGRAPHY

J. S. Gamble.—*Bambusae of British India* (Calcutta, 1896).

W. E. D'Arcy.—*Preparation of Forest Working-Plans in India*, 3rd edition (Calcutta, 1898).

Baden-Powell.—*Forest Law* (1893).

W. R. Fisher.—*Manual of Indian Forest Botany*, Pt. 1 (Roorkee, 1888).

J. S. Gamble.—*Manual of Indian Timbers* (1902).

W. Schlich.—*Manual of Forestry*, vols. i to v (1889–96).

E. C. Cotes.—*Indian Forest Zoology* (Calcutta, 1893).

E. P. Stebbing.—*Injurious Insects of Indian Forests* (Calcutta, 1899).

Sir D. Brandis.—*Indian Forestry* (Woking, 1897).

B. Ribbentrop.—*Forestry in British India* (Calcutta, 1900).

Annual Provincial Reports on Forest Operations: printed at the Government Presses of the respective Provinces.

CHAPTER III

MINES AND MINERALS

The peculiar tren d in the development of Indian minerals.

THE feature which stands out most prominently in a survey of the mineral industries of India is the fact that practically nothing has been done to develop those minerals which are essential to modern metallurgical and chemical industries, while most striking progress has been made during recent years in opening out deposits from which products are obtained suitable for export, or for consumption in the country by what may conveniently be called direct processes.

Decline of ancient chemical industries.

In this respect India of to-day stands in contrast to the India of a century ago. The European chemist, armed with cheap supplies of sulphuric acid and alkali, and aided by low sea freights and increased facilities for internal distribution by the spreading network of railways, has been enabled to stamp out, in all but remote localities, the once flourishing native manufactures of alum, the various alkaline compounds, blue vitriol, copperas, copper, lead, steel and iron, and seriously to curtail the export trade in nitre and borax. The high quality of the native-made iron, the early anticipation of the processes now employed in Europe for the manufacture of high-class steels, and the artistic products in copper and brass gave the country a prominent position in the ancient metallurgical world, while as a chief source of nitre India held a position of peculiar political importance until, less than forty years ago, the chemical manufacturer of Europe found, among his by-products, cheaper and more effective compounds for the manufacture of explosives.

Increase in mineral imports.

With the spread of railways, the development of manufactures connected with jute, cotton, and paper, and the gradually extending use of electricity, the demand for metallurgical and chemical products in India has steadily grown. Before long the stage must be reached at which the variety and quantity of products required, but now imported, will satisfy the conditions necessary for the local production of those which can be economically manufactured only for the supply of groups of industries.

During the three years 1901–3, the annual value of the imports into India of minerals and products directly obtained from minerals averaged £10,158,252; and this is exclusive of glassware, earthenware, porcelain, hardware, cutlery, machinery, millwork, and railway plant, of which the value is, of course, very much greater than that of the materials from which they are manufactured. The value of these articles would add almost £8,000,000 sterling to the sums detailed in the following table, which shows the values declared for imported simple minerals and direct mineral products, nearly all of which are represented among the known resources of India:— Value of imported minerals and mineral products.

IMPORTED ARTICLES.	1901.	1902.	1903.	Average.
	£	£	£	£
Mineral oils and paraffin	2,835,815	2,231,946	2,302,865	2,456,875
Iron	2,249,740	2,088,777	2,396,208	2,244,908
Steel	1,417,297	1,396,634	1,739,976	1,517,969
Copper . . .	692,836	1,258,548	1,321,144	1,090,843
Precious stones and pearls, unset	674,818	843,520	987,618	835,319
Salt	488,107	458,251	408,941	451,766
Inorganic chemicals .	377,220	375,933	379,338	377,497
Coal, coke, and patent fuel	332,093	336,420	238,428	302,314
Tin	159,157	177,138	226,925	187,740
Building materials: stone, marble, cement, &c.	148,951	177,149	198,811	174,970
Lead	157,436	127,504	124,392	136,444
German silver . .	144,282	139,955	98,605	127,614
Zinc or spelter . .	79,392	87,986	96,588	87,989
Metals, unenumerated .	51,295	86,521	77,136	71,651
Brass	54,653	90,449	53,149	66,084
Quicksilver . .	26,596	27,562	30,648	28,269
TOTAL	9,889,688	9,904,293	10,680,772	10,158,252

The chief items among imported mineral products are the metals, which, during the three years mentioned, had an average value of £5,500,000 sterling, without counting the value of the metals used in imported machinery, railway plant, and hardware. Iron and steel together constitute 37 per cent. and copper 10·7 per cent. of the total, while the other valuable articles are mineral oil 24·2 per cent., precious stones and pearls 8·2 per cent., and salt 4·4 per cent. The chief imported mineral products.

In the table on the next page an attempt is made, by adding together the so-called values of the minerals for which returns Value of minerals produced.

are obtainable, to estimate the progress in the mining industry of India during the past six years. These *values* are not in any sense comparable with those for the same minerals imported from other countries; they are in reality the *prices* obtainable, either at the pit-mouth in the case of coal and minerals consumed in the country, or at the sea-coast in the case of minerals exported. In the case of manganese ore, for instance, the value returned as nearly £1 a ton at the Indian seaboard is about half that ultimately paid for the mineral by the steel-manufacturer.

From this table it will be seen that there has been a steady, uninterrupted progress in production, from an estimated value of £3,455,565 in 1898 to £4,988,527 in 1903—an increase of 44·6 per cent. in five years. To this increase almost every mineral has contributed.

MINERALS.	1898.	1899.	1900.	1901.	1902.	1903.	Average.
	£	£	£	£	£	£	£
Gold .	1,608,504	1,724,906	1,891,767	1,930,411	1,970,230	2,302,493	1,904,719
Coal * .	957,162	1,063,820	1,343,081	1,323,372	1,366,909	1,299,716	1,225,677
Salt † .	358,933	312,682	325,970	409,019	344,633	336,147	347,897
Saltpetre ‡	265,896	232,896	256,210	294,249	237,880	288,487	262,603
Petroleum §	67,897	125,684	148,755	200,342	217,816	354,365	185,810
Rubies .	57,950	90,848	97,326	104,476	86,895	98,575	89,345
Mica ‡ .	53,890	73,372	109,554	70,034	87,594	86,277	80,120
Manganese ore	27,426	39,529	77,304	79,119	120,538	132,741	79,443
Jadestone ‖	41,780	42,120	58,955	46,377	31,713	47,676	44,770
Iron ore ‖ .	12,403	12,836	11,171	13,598	16,533	14,963	13,584
Graphite § .	110	7,620	9,145	13,635	24,410	16,970	11,981
Tin . .	2,553	7,900	8,534	7,773	5,340	9,153	6,875
Magnesite §	...	56	150	...	2,360	550	519
Amber .	1,061	151	103	11	432	414	362
TOTAL	3,455,565	3,734,420	4,338,025	4,492,416	4,513,283	4,988,527	4,253,705

* Spot prices. † Prices without duty. ‡ Export values. § Estimated values.
‖ Estimated values for Provinces other than Bengal.

Classification of valuable minerals.

The products may conveniently be described in the order to be adopted in the official Manual of Economic Geology, which will contain a summary and complete list of the papers and reports hitherto published.

In this system of classification the minerals are grouped as follows:—

I. *Carbon and its compounds*, including coal, petroleum, amber, and graphite.

II. *Metalliferous minerals*, including the ores of gold, silver, tin, copper, zinc, lead, antimony, iron, manganese, chromium, nickel, cobalt, tungsten, titanium, and aluminium.

III. *Materials for construction*, including building and ornamental stone, slate, lime, cement, brick-clay, and sand.

IV. *Minerals used in various industries*, such as abrasive materials, mineral pigments, refractory materials and materials used for pottery, for other indigenous industrial arts, for agriculture, and for the chemical industries.

V. *Gem-stones*.

Coal, which takes the first place in our system of classification, is at the same time, to the country as a whole, the most valuable mineral product being worked. Its actual value, as estimated by the low price which is accepted for it in sales at the pit-mouth, comes next to that of gold; it is by far the largest supporter of labour, and 94 per cent. of the material raised is consumed in developing the domestic industries of the country. Coal.

During the past twenty years the production of Indian coal has risen from 1,397,818 tons in 1884 to 7,438,386 tons in 1903, and the consumption by the growing manufacturing industries has progressed in a similar degree.

The railways have been the chief consumers of Indian coal, and their rapid extension has naturally introduced it to new markets, supplying the requirements of the large ports and the rapidly growing manufacturing industries near the large cities. In 1884 only 68·9 per cent. of the coal consumed on Indian railways was of domestic origin; but this proportion has gradually risen until in 1903, out of 2,221,585 tons of coal consumed by the railways, 99·2 per cent. was obtained from Indian collieries. Consumption of Indian coal by the railways.

The total imports of foreign coal have decreased, but in a smaller proportion, from 848,367 tons in 1894 to 192,729 tons in 1903, while markets have been found for Indian coal at the Indian Ocean ports, and exports have gradually risen from the beginning of the trade in 1886 to 441,948 tons in 1903. It is evident from the comparatively small amount of both imports and exports that the great development in the production of Indian coal has been made possible by increased consumption in domestic industries. The total local consumption is now about 94 per cent. of the production, and 30 per cent. of the Imports and exports of coal. Total consumption of coal.

average annual consumption of nearly 6,000,000 tons of coal during the past five years has been taken by the railways. Although the coal consumption on the railways has been gradually rising, the production and total consumption in the country have increased at a greater rate; and it is evident, therefore, that other coal-consuming industrial enterprises have developed quite as rapidly as the railways.

Sources of the coal.

Of the total output of Indian coal during the past twenty years, about 95 per cent. was raised from the Gondwāna coal-fields of the Peninsula, the remainder being obtained from seams of Tertiary age in Burma, Assam, the Punjab, and Baluchistān.

The Gondwāna fields.

The following table shows the output from the Gondwāna coal-fields during the past five years:—

PROVINCE AND FIELD.	1899.	1900.	1901.	1902.	1903.
BENGAL:	Tons.	Tons.	Tons.	Tons.	Tons.
Daling . . .	2,098	1,490	. .	. .	. .
Daltonganj . .	. .	707	3,881	19,352	33,557
Gīrīdīh . .	628,777	712,727	694,806	776,656	766,871
Jherriā . .	1,007,236	1,710,757	1,946,763	2,420,786	2,493,729
Rājmahāl . .	412	397	436	219	335
Rānīganj . .	2,396,742	2,552,414	2,841,699	3,042,223	3,066,720
CENTRAL INDIA:					
Umariā . .	164,569	164,489	164,362	171,538	193,277
CENTRAL PROVINCES:					
Mohpāni . .	23,596	39,612	43,046	43,645	31,443
Pench valley .	. .	. .	. .	. .	88
Warorā . .	132,980	133,230	148,470	153,336	127,623
HYDERĀBĀD:					
Singareni . .	401,216	469,291	421,218	455,424	362,733
TOTAL	4,757,626	5,785,114	6,264,681	7,083,179	7,076,376

The Bengal coal-fields.

The most valuable of the coal-fields in Bengal are patches of Gondwāna strata, faulted into the Archaean schists and gneisses, and arranged as a band roughly east to west along the valley of the Dāmuda river.

The Rānīganj field.

The easternmost of these fields, known as the Rānīganj field, being the nearest to Calcutta, and consequently the earliest to be connected by railway with the chief market for coal, was the first to be opened up, and is still the chief producer, having yielded 41·2 per cent. of the total coal-production in 1903. Coal was worked in this field more than a century ago, but its output merely supplied local requirements until the East Indian Railway entered the field in 1854.

The Gondwāna system is represented in the Rānīganj field by beds ranging from the Tālcher series to the Pānchets (cf. Vol. I, chap. ii), the strata being so disposed, with a general southerly dip, that the oldest rocks are found resting on the Archaean gneisses on the northern boundary of the field, while the younger series follow in order as bands, with outcrops trending roughly east and west, until in the south the Pānchets are found as irregularly shaped outliers. The coal is confined to the Dāmuda series, which in this field is divided into— Classification of the Gondwānas in the Rānīganj field.

3. Rānīganj stage	. . .	about 5,000 feet.
2. Iron-stone shales	. . .	about 1,400 feet.
1. Barākar stage	. . .	2,000 feet.

Coal-seams occur in the Barākar and Rānīganj stages, and in this field about 69 per cent. of the total output is obtained from the younger or Rānīganj seams. The formation lying between is worked for its clay iron-stone nodules, which are used in the blast furnaces at the Barākar iron-works.

Coal from the older Barākar seams differs from that raised from the Rānīganj stage in containing a smaller percentage of moisture and volatile hydrocarbons, with a larger proportion of fixed carbon. The distinction is specially constant in regard to the included moisture. Barākar coals yield very nearly 1 per cent. of moisture, while the average amount in a series of assays of samples from the lower seams of the Rānīganj stage is 3·81, and from the upper seams of the stage 6·86 per cent. Composition of Rānīganj and Barākar coals.

Next to Rānīganj in importance, and gradually approaching it in output, comes the Jherriā field, which is about 27 miles long and 9½ wide, including only the Rānīganj iron-stone shale and Barākar stages of the Dāmuda series, with the basement beds of Tālchers. Workable coal occurs in the Rānīganj stage; but operations have hitherto been confined to the Barākars, in which there are eighteen well-defined and mostly valuable seams, varying from 5 to 30 feet in thickness. As in the Rānīganj field, a large amount of damage has been done to the coal in this field by dikes and sheets of a peculiar igneous rock, which in composition agrees more with the peridotite family than with any other. The quantity of coal available is, however, so manifestly in excess of the present, and immediately probable, demands that the question of considering a possible exhaustion of supplies may be postponed indefinitely. Ten years ago the Jherriā field was not worked; but in 1894, The Jherriā field.

following its connexion by a branch line with the East Indian Railway system, the output was 14,818 tons, and from this beginning the production rapidly increased, until in 1903 the output of Jherriā (2,493,729 tons) represented one-third of the total coal-production of India.

The Bokāro and Rāmgarh fields.

The coal-field of Bokāro, covering 220 square miles, lies near the west end of Jherriā. There are some very thick seams in the field, and the total available coal supply is estimated to amount to 1,500,000,000 tons. The smaller field of 40 square miles, situated in the Rāmgarh *ilāka* of Hazāribāgh District, includes representatives of the stages ranging from the Tālchers to the Rāniganj beds; but the coal is much disturbed, and apparently not so pure as in the previously mentioned areas.

The Karanpurā fields.

At the head of the Dāmuda valley the two Karanpurā fields lie at the base of the southern scarp of the Hazāribāgh plateau. Of the two patches of Gondwāna rocks which contain coal in this area, the southern covers 72 square miles, while the northern field has an area of 472 square miles. Some of the coal appears to be of excellent quality, and the amount available in both fields is estimated at 8,825,000,000 tons.

The Daltonganj field.

A field which has recently been opened up lies near Daltonganj, the administrative head-quarters of Palāmau District. The connexion with the East Indian Railway system, made in 1901, opened this field for the market of the United Provinces, and in that year work commenced in earnest with an output of 3,881 tons, the production rising to 33,557 tons in 1903.

The Gīrīdīh field.

The small patch of Gondwāna rocks, covering only 11 square miles, near the head-quarters of the Gīrīdīh subdivision of Hazāribāgh District, produces the best steam coal raised in India. In 1844 it was estimated that the remaining resources of the field would yield about 82,500,000 tons of coal, and this is being taken out at the rate of 750,000 tons a year.

The Sātpurā group of fields.

In the area between the isolated Mandlā mass of Deccan trap on the east and the main expanse of the same formation to the west, we have an exposure of Gondwāna rocks, which must have been preserved for some time by the Deccan trap cover, and have thus been exposed to the weather comparatively recently. The chief exposures are thus the Upper Gondwānas, which form the Mahādeva section of the Sātpurā range, on which the station of Pachmarhī is situated. Underneath these, however, the lower coal-bearing Gondwānas are preserved, cropping out on the north side near Mohpāni, in Narsingh-

pur District, and on the south in the Districts of Betūl and Chhindwāra. To what distance this group of Gondwāna rocks runs east and west under the Deccan trap and the Narbadā alluvium is not known; the exposure gives us a glimpse of the mineral wealth which is hidden by the great system of trap-flows.

The Mohpāni area was worked from 1862 to 1904 by the Nerbudda Coal and Iron Company, and was then handed over to the control of the Great Indian Peninsula Railway Company, by which most of the coal hitherto produced has been consumed. A recent estimate gives the amount of workable coal in this field as rather more than 8,000,000 tons. The Mohpāni field.

The great belt of Gondwāna rocks, which stretches north-west from the neighbourhood of Rājahmundry along the valley of the Godāvari and Wardhā rivers, passes under the Deccan trap-flows about 60 miles south of Nāgpur. At Warorā, near its north-western end in Chānda District, and at Singareni to the south-east in the Nizām's Dominions, portions of the enormous stores of coal in this great belt have been worked. The Godāvari belt of Gondwāna rocks.

The collieries near Warorā have been worked since 1871 by the Government, but considerable difficulties have been met with, owing to the great influx of water in the mines, and to the occurrence of underground fires arising from the spontaneous combustion to which the coal is liable. A large quantity of the coal in this field has been completely destroyed by fire, and the amount which can be profitably extracted is now rapidly approaching exhaustion. Operations are in progress for the extension of the railway beyond Warorā, and for the development of the thick seams of coal known to exist to the south of Chānda near the Wardhā river. The Warorā field.

The Singareni coal-field is an elongated strip of Lower Gondwāna rocks near Yellandu in the Nizām's Dominions, having an area of 19 square miles. The principal seam worked is about 5 or 6 feet thick, and is estimated to contain over 40,000,000 tons of coal, but thicker seams are also being opened up gradually. Since the commencement of mining operations in this coal-field in 1886 the output has rapidly risen to more than 400,000 tons a year. The Singareni field.

The band of Gondwāna beds preserved in the valley of the Mahānadī and its tributaries covers nearly as much ground as that in the Godāvari valley, and although the lower coal-bearing beds are known at several places, the seams have not yet been worked. Those of Tālcher, Rāmpur (Ib river), Raigarh, and Korba are in Bengal, while farther north-west, on entering the The Mahānadī group of Gondwāna rocks.

area under the Central India Agency, we have the fields of Singrauli, Sohāgpur, and Umariā beyond the limits of the Mahānadī basin.

The Umariā field.

The only coal worked on the Mahānadī group of Gondwāna exposures is that occurring near Umariā in the State of Rewah, on the Katnī-Bilāspur branch of the Bengal-Nāgpur Railway. Six good seams are known in this field, but only four are worked. The amount of workable coal proved by shafts and borings is estimated to be about 24,000,000 tons. The collieries were opened up in 1882, and the output has gradually increased to 193,277 tons in 1903.

The Darjeeling field.

The only Gondwāna coal occurring in India outside the limits of the Peninsular area is that which has been prospected in the Darjeeling area and farther east in Bhutān and Assam. As the Gondwāna rocks in these areas have been involved in the folding movements by which the Himālayan range was formed, the coal-seams have been crushed, and the physical characters of the coal itself have been impaired, while additional difficulty in working would be caused by the highly inclined and faulted character of the seams.

Cretaceous and Tertiary coals.

The younger coals are nearly all of Cretaceous and Tertiary age, although some thin and poor seams of Upper Jurassic coal have been worked in Cutch.

Coal of Tertiary age is found in Sind, Rājputāna, Baluchistān, along the foothills of the Himālayas, farther east in Assam, in Burma, and in the Andaman and Nicobar Islands. The most frequent occurrence is in association with Nummulitic limestones, though the richest deposits, namely those in north-east Assam, are younger, probably miocene, in age. Of these extra-peninsular fields, the only formations producing coal are of Tertiary age. The output for each of these for the past five years is shown in the table on the next page.

On the whole, the younger coals, which are being worked in extra-peninsular areas, differ from the Gondwāna coals in containing a larger proportion of moisture and volatile hydrocarbons; and though as variable in composition as they are in thickness of seam, some coals are obtained, as for instance in Assam, with a remarkably low percentage of ash and a high calorific value. The high proportion of moisture in some of these younger coals is, however, often a serious cause of deficiency in calorific value.

North-east Assam.

The most promising among these is the group of occurrences in north-east Assam, one of which is now being worked by the Assam Railways and Trading Company, which commenced

operations at Mākum (27° 15′ N.; 95° 45′ E.) in 1881. The collieries are connected by a metre-gauge railway with Dibrugarh on the Brahmaputra river, which, being navigable by steamers, forms both a market and a means of transport for the coal.

Province and Field.	1899.	1900.	1901.	1902.	1903.
	Tons.	Tons.	Tons.	Tons.	Tons.
Assam:					
Mākum . . .	232,933	215,962	254,100	220,640	239,328
Smaller fields . .	807	774	. .	456	. .
Baluchistān:					
Khost	11,689	17,664	18,431	25,982	36,444
Sor Range and Mach	265	5,617	6,225	7,907	10,465
Burma:					
Shwebo: Thingadaw	8,105	10,228	12,466	13,302	9,306
Kashmīr:					
Ladda . . .	. .	. .	. .	1,138	999
Punjab:					
Dandot and Pidh .	81,218	74,083	67,730	55,373	43,704
Other mines . .	617	. .	. .	. .	. .
Rājputāna:					
Bīkaner . . .	. .	9,250	12,094	16,503	21,764
Total	335,634	333,578	371,046	341,301	362,010

The coal-bearing rocks to which the Mākum field belongs stretch for 40 miles to the north-east, and can be traced for 100 miles to the south-west, along the northern front of the Pātkai range. Near Mārgheritā, where the collieries are situated, the average thickness of the thickest seam now worked is about 50 feet, and in the Namdang section it increases to as much as 80 feet, and is persistent with little variation for a distance of 6 miles.

An interesting feature in connexion with these coal-measures is the almost constant association with them of mineral oil and brine springs.

It is only necessary to refer briefly to the chief among the remaining occurrences of Tertiary coal in the extra-peninsular areas. Besides that which has been worked with indifferent success in the Shwebo District of Burma, where the output reached 13,000 tons in 1902 but is now rapidly declining, the thick coal-seams in the Lashio and Nammaw fields in the Northern Shan States are receiving attention on account of their proximity to the Mandalay-Lashio Railway. Burma.

Possibly the most important of the coal deposits in the west occur in Baluchistān, where, however, the disturbed state of the rocks renders mining operations difficult, expensive, and often Baluchistān, Khost.

dangerous. Besides the small mines now open in the Sor range, south-east of Quetta, and in the Bolān Pass at Mach, collieries have been worked since 1877 at Khost (30° 12′ N.; 67° 40′ E.) on the Sind-Pishīn Railway. The two seams worked have an average thickness respectively of 26 and 57 inches, and since the commencement of mining operations in 1877 the output has gradually increased to 36,444 tons in 1903.

Punjab, Dandot.

The coal which has been most worked in the Punjab is that long known to exist in Jhelum District, on the Dandot plateau of the Salt Range. The only valuable seam varies in thickness from 18 to 39 inches, forming a basin under the Nummulitic limestone. The mines at Dandot and at Pidh, three miles to the north-east, have been worked for the North-Western Railway since 1884. Recently the collieries have shown a decline in output, from a maximum of 81,218 tons in 1899 to 43,704 tons in 1903, and during the last two years they have been worked at a loss.

Punjab, Miānwāli District.

Some minor works, not beyond the scale of ordinary prospecting operations, have been conducted on the deposits of Jurassic coal in Miānwāli District. The deposits two miles north of Kālābāgh are estimated to contain about 72,000 tons of coal, of which less than 1,000 tons a year are being extracted. More promising deposits of Tertiary coal occur in the Maidān range, twenty-four miles farther west, but no mining in this locality has as yet been attempted.

Rājputāna, Bīkaner.

A lignite of dark-brown colour, with included lumps of fossil resin, occurs in association with Nummulitic rocks at Palāna in the State of Bīkaner, Rājputāna. In 1898 mining operations were started at a point where the seam was found to be 20 feet thick; and a branch line, 10 miles long, to the Jodhpur-Bīkaner Railway, has been constructed to assist the development of the colliery. There has been a gradual increase in output since 1900, the return for 1903 being 21,764 tons. The physical characters of the natural fuel form a drawback to its use in locomotives; but recent experiments are said to show that satisfactory briquettes can be made, in which the proportion of moisture is reduced, and the fuel rendered less susceptible to atmospheric action.

Petroleum.

More rapid progress has been made during the past few years in developing the petroleum resources of India than in the case of any other mineral product. In 1894 the production amounted to 11,500,000 gallons of crude oil; by 1903 it had risen to nearly 88,000,000 gallons. India, however, contributed only 1·29 per cent. of the world's supply of mineral oil in the

same year, and is still a large importer of foreign oil, of which about 75 per cent., amounting to 64,000,000 gallons a year, comes from Russia, and 19 per cent. from the United States, while large quantities are now being obtained from the productive fields in the Dutch East Indies.

The petroleum resources of India are confined to the two systems of folded rocks at either end of the Himālayan arc— Occurrences of Indian petroleum.

(1) the Irānian system on the west, including the Punjab and Baluchistān, and continued beyond British limits into Persia, where the oil-fields have attracted interest for many years;

(2) the Arakan system on the east, including Assam and Burma, with their southern geotectonic extension to the highly productive oil-fields of Sumatra, Java, and Borneo.

In both areas the oil is associated with Tertiary strata, and has probably had similar conditions of origin, but the structural features of the two areas are not equally suitable for the retention of oil in natural reservoirs. In Burma, however, the conditions are ideal: the well-known Yenangyaung field lies in a NNW.—SSE. flat anticline, the axis of which by variation in pitch has produced a flat dome in the Kodoung tract. The rocks in this dome include several porous sands at a depth of over 200 feet, covered by impervious clay-beds, which help to retain the oil. In the Baluchistān area the rock-folds have been truncated by agents of denudation, or have been dislocated by earth-movements, and much of the original store of oil has consequently disappeared. Oil-springs are common enough, but they are not connected with reservoirs which can be tapped by artificial means.

Punjab. In the Punjab, oil-springs have been known for many years to exist in Rāwalpindi District and farther to the south-west; but the total output of the Punjab is small, ranging between 1,000 and 2,000 gallons a year.

Baluchistān. Unsuccessful attempts have been made to develop the oil resources indicated by springs in different parts of Baluchistān. The most prominent of these are near Khattan in the Marri Hills and Moghal Kot in the Shirāni country, where small springs, examined in 1891, were found to yield oil of a very high quality.

Assam. As long ago as 1865 an account of the Mākum area was published by Mr. H. B. Medlicott, in the *Memoirs of the Geological Survey*, and trial borings were then recommended. This advice was followed in 1867, when a Calcutta firm

obtained permission to prospect, and struck a promising oil-spring at a depth of 118 feet near Mākum; but nothing more was done until 1883, and only very slow development occurred during the following sixteen years. The Assam Oil Company was, however, formed in April, 1899, with a nominal capital of £310,000, most of which was quickly called up and invested in the erection of a new refinery at Digboi and in systematic drilling operations, with the result that the output rose from 632,000 gallons in 1901 to 2,529,000 gallons in 1903.

The belt of Tertiary rocks, stretching from the north-eastern corner of Assam for about 180 miles south and west, shows frequent signs of oil, nearly always in association with coal and sometimes associated with brine-springs and gas-jets. The series of earth-folds in this corner of Assam stretches southwards to Cāchār, and through the little-known Lushai Hills into Arakan; in the same system of parallel folds occur the oil-fields of the Arakan coast on one side of the Yoma (range) and those of the Irrawaddy valley on the other.

Burma. The most productive oil-fields of Burma are those on the eastern side of the Arakan Yoma (range), in the Irrawaddy valley, forming a belt stretching from Magwe District, in which the well-known field of Yenangyaung occurs, through Myingyan which contains Singu, across the Irrawaddy into Pakokku where Yenangyat is situated. Oil is, however, known farther south in Minbu, Thayetmyo, and Prome, and farther north in the Chindwin valley; but these areas have not yet been thoroughly prospected, and the great development which has recently taken place is the direct outcome of work in the three fields, Yenangyaung, Yenangyat, and Singu. The following table shows the production of the Burma oil-fields for the past five years:—

YEAR.	Yenangyaung, Magwe District.	Singu, Myingyan District.	Yenangyat, Pakokku District.	Akyab.	Kyaukpyu.	TOTAL.
	Gallons.	Gallons.	Gallons.	Gallons.	Gallons.	Gallons.
1899	22,111,514	...	10,030,790	50,559	116,668	32,309,531
1900	27,123,325	...	9,701,769	36,852	112,342	36,974,288
1901	37,482,935	...	11,843,341	22,355	93,103	49,441,734
1902	40,712,142	174,880	13,824,390	36,794	100,774	54,848,980
1903	56,920,662	5,617,381	22,665,518	52,968	71,962	85,328,491

Amber. An amber-like fossil resin is worked in the Hukawng valley, and occurs in very small quantities under somewhat similar

conditions in clays of Miocene age at Mantha in Shwebo District, and in the oil-field of Yenangyat in Pakokku District, Upper Burma. Much of the material brought from the Hukawng valley is sold in the Mandalay bazar for the manufacture of beads for rosaries, *nadaungs* (ear-cylinders), and other trinkets for personal ornament.

The amber of Burma differs in chemical and physical characters from previously known varieties, and the name 'burmite' has consequently been suggested for it. The well-known amber of Eastern Prussia contains from $2\frac{1}{2}$ to 6 per cent. of succinic acid, and is consequently known to the mineralogist as succinite; but the Burmese amber contains no succinic acid, though the products of its dry distillation include formic acid and pyrogallol. Chemical and physical properties of Burmese amber.

Graphite occurs in small quantities in various parts of India—in the so-called khondalite series of rocks in the Vizagapatam Hill-tracts and adjoining Chhattīsgarh Feudatory States, in a corresponding series of rocks in Coorg, in the Godāvari District of the Madras Presidency, and in the Ruby Mines District of Upper Burma. But no progress has been made in mining except in the State of Travancore, where the amount of graphite raised in 1903 was 3,394 tons. Graphite.

Of the metalliferous minerals known to occur in India, none have been worked in recent years except gold, tin, iron, manganese, and chromium. Platinum, iridium, silver, copper, zinc, lead, antimony, nickel, cobalt, tungsten, titanium, and aluminium are known to occur, and for some of them a considerable amount of prospecting has been undertaken. Metalliferous minerals.

The most valuable among the metals is gold, which, besides being washed in small quantities in the river gravels of various parts of India, is mined from a rich reef on the Kolār field in the State of Mysore. The attention of European prospectors was directed to this area by numerous native workings of unknown age; and since operations commenced on a large scale, shortly after 1880, the gold extracted, up to the end of 1903, has reached a value of nearly £19,000,000 sterling. During this period five companies have paid £8,250,000 in dividends, while the Mysore State has received nearly £1,000,000 as its royalty. The deepest workings, now somewhat more than 3,000 feet below the surface, show little diminution in the value or width of the auriferous quartz vein. During the past five years the amount of quartz crushed has increased from 337,636 tons in 1898 to 546,752 tons in 1903, and the value of gold extracted has increased from £1,576,000 in 1898 Gold. Kolār.

to £2,284,000 in 1903. The yield per ton of quartz crushed has declined during the same period from £4·668 to £4·177, the economies introduced by extended experience in mining and milling the ore having permitted the extraction of lower grades of quartz.

Of the improvement schemes which tend to reduce working expenses, and thus prolong the life of the Kolār gold-field, the introduction of electric power from the Cauvery Falls, undertaken by the Mysore State, is probably the most important. The supply commenced about the middle of 1902, and has regularly provided a little more than 4,000 horse-power to the various mining and metallurgical works. The power is transmitted from the Cauvery Falls over duplicate lines 91½ miles long. The cost to the companies for the first year was £29 per horse-power, reduced in succeeding years to £18. The success of the scheme has led to its enlargement, and works in progress will enable the Mysore State to increase materially the power available for consumption.

Ancient workings.

The Dhārwār system of foliated schists, forming the 'country rock' of the auriferous quartz in the Kolār field, is represented by bands of similar rocks folded into the gneisses in various parts of the Peninsula. In many places quartz-veins in these rocks have been worked for gold by past generations, of whom little or nothing is known except from the traces of their ancient attempts at mining, which in some cases were by no means on a small scale, as workings have been found in the Nizām's Dominions and in Dhārwār extending to depths of more than 500 feet.

In the Gāngpur State and in parts of the District of Singhbhūm, in Chotā Nāgpur, there are numerous accumulations of rude stone-crushers and mortars, which were apparently used by the ancient workers for grinding the auriferous vein-stuff. In this particular area, however, no deep workings have been discovered; and it seems probable that the ancients made many attempts to extract the gold which is widely disseminated in this area, but, like the many prospectors who have worked in Chotā Nāgpur during recent years, found no spot sufficiently remunerative for extensive operations.

Nizām's Dominions.

Outside the Mysore State, the only operations on gold quartz which have been developed to an appreciable degree are those of the Hutti and Wundalli mines in the Nizām's Dominions, and of Kyaukpazat in Upper Burma. At the Wundalli mines 7,822 ounces of gold were recovered in 1899; but the mines were closed in 1900, and the Hutti mine was the only one still

at work at the end of 1903. Crushing commenced at the Hutti mine in February, 1903, and the subsequent monthly returns have shown a gradually increasing output of gold, the total for 1903 being 3,414 ounces. The Kyaukpazat mine in Burma for some years raised between 1,000 and 2,000 ounces of gold a year; but in 1903 the particular auriferous chute exploited was worked out, and the mine, after some exploratory operations, was closed. Burma.

Alluvial gold. Alluvial gold-washing is carried on in many places in British India; but from the fact that the washers invariably combine this pursuit with other occupations, and because the individual return is exceedingly small and is locally absorbed for jewellery, complete statistics are not available. Returns for 1903 show, however, that 106 ounces of alluvial gold were obtained from the Ladākhi *wazārat* of the Kashmīr State. This amount may perhaps be fairly taken as an indication of the annual yield from this portion of the Upper Indus.

Dredging for alluvial gold above Myitkyinā on the Upper Irrawaddy was commenced about November, 1902, with a dredger capable of dealing with 10,000 tons a week. The whole of the season (until June, 1903) was spent in prospecting the river-bed. Five or six spots were thus tried, and the results were considered to be sufficiently satisfactory to warrant an increase of dredgers.

During the past two years surveys of the auriferous deposits of India have been in progress. These, so far as they go, give little hope of the discovery of rich alluvial deposits in Peninsular India, or indeed in any part of India affected by the monsoon rains, and dependent on them alone for the supply of the rivers. For concentration of gold a comparatively equable current is essential—a condition rarely obtainable in the gravel river-beds of India, where alone gold would be found, for these are almost dry during the cold weather and become roaring torrents in the rains.

The greater possibilities of dredging on the Irrawaddy appear to arise from the fact that the waters of that river are derived from ranges where, even during the cold weather, the rainfall is heavy.

Tin. Isolated crystals of cassiterite have been found as constituents of pegmatite veins in the Pālanpur State and in Hazāribāgh District, while in the latter area instances are recorded of the accidental production of tin from river-sands by the native iron-smelters. The principal deposit of tin ore in Hazāribāgh District occurs in the Pālganj estate near the Barākar river;

and unless the prospecting operations carried out some years ago were wrongly described, this deposit has received less attention than it deserves.

The only persistent attempts made to work tin have been in Burma, where cassiterite is obtained by washing river-gravels in the Bawlake State, Karenni, and in the Tavoy and Mergui Districts of Southern Burma. The average annual production in the last-named Districts is about 83 tons a year, valued at slightly under £7,000.

It is not without significance that these deposits in Burma occur in a belt which is notably stanniferous on the north side in the Yunnan Province of China, and farther south in the Malay Peninsula, where the rich alluvial deposits produced 54 per cent. of the world's supply in 1903. Veins carrying tin ore are found in the granitic rocks which have given rise by disintegration to the alluvium in which the ore is concentrated, but such occurrences *in situ* have never yet proved rich enough in the Malay Peninsula to be worth mining.

The production of tin in India does not nearly approach the requirements of the country. The average annual import of block tin, nearly all obtained from the Straits Settlements, amounts to 1,343 tons, valued at £137,000.

Copper.

Copper was formerly smelted in considerable quantities in Southern India, in Rājputāna, and at various places along the outer Himālayas, where a persistent belt of killas-like rock is known to be copper-bearing in numerous places, as in Kulū, Garhwāl, Nepāl, Sikkim, and Bhutān. In Chotā Nāgpur several attempts have been made to work lodes reputed to be rich in the metal; but in all such attempts the ore has been smelted for the metal alone, and no effort has been made hitherto to utilize the accompanying sulphur as a by-product. In Singhbhūm District, a copper-bearing belt persists for a distance of 77 miles, and includes several rich lodes, some of which, at Rājdoha, have been proved by extensive prospecting operations to depths of 233 feet. At Bāraganda in the Gīrīdīh subdivision of Hazāribāgh, a low-grade ore-bed of about 14 feet in thickness has been prospected by shafts to a depth of 330 feet, and an unsuccessful attempt has been made to work the ore.

The recent considerable increase in the value of copper and brass imported from Europe has revived interest in the deposits in India. From the table given on page 129 it will be seen that the imports of copper rose in value from £692,836 in 1901 to £1,321,144 in 1903, and now form more than

10 per cent. of the average total imports of minerals and mineral products and about 20 per cent. of the total value of imported metals.

Lead, silver, and zinc.

Galena is very widely distributed throughout the Purāna rocks and older crystalline schists. In a very large number of these occurrences considerable proportions of silver have been obtained by assay; but although the galena was largely worked by natives in the past for both silver and lead, the attention of European investors has not persisted beyond the prospecting stage.

Near Pangyang in the Northern Shan States an attempt is now being made to work lodes in which ores of lead, silver, and zinc are associated with one another, and which were formerly worked on an extensive scale by the Chinese, who have left large quantities of argentiferous slag possibly amenable to treatment by modern metallurgical processes.

Antimony.

Prospecting operations for antimony ores, among which stibnite is the most prominent, have been carried on in Southern Burma, and in Lāhul, where a large deposit occurs near the Shigri glacier. The latter site is included in a mining lease recently granted, and an attempt is about to be made to mine the ore.

Iron.

Although only one attempt to manufacture iron on European lines has been successful in India, the country has established a reputation for large deposits of rich and valuable ores; and there is no doubt that the existing manufacture of wrought iron by a direct process was widespread before the date of the most ancient historical records, while the manufacture of the ancient *wootz* anticipated by many centuries the cementation process developed in Europe for making the finest qualities of steel.

The native iron-smelting industry has been practically stamped out by cheap imported iron and steel within range of the railways; but it still persists in the more remote tracts of the Peninsula, and in some parts of the Central Provinces shows signs of slight improvement.

The most abundant iron ores are the minerals magnetite and hematite, which occur in numerous places with quartz, making quartz iron-ore schists which are generally members of the Dhārwār and other Archaean schist series. The most conspicuous examples of this class occur in the Salem District and the Sandūr State within the Bellary District of Madras, and in the Chānda, Raipur, and Jubbulpore Districts of the Central Provinces.

The chief ore now used at the Barākar iron-works for the manufacture of pig-iron is a clay-ironstone containing 45–48 per cent. of iron, and occurring as nodules in a shaly formation separating the Barākar and Rānīganj stages of the Dāmuda series in Bengal. Until recently pig-iron only was made at the Barākar iron-works, but arrangements are now complete for the manufacture of basic steel.

Manganese production. The mining of manganese ore has sprung up within the last twelve years, and has developed so rapidly that India now takes second place among the manganese-producing countries in the world, with an output during the year 1903 of 171,806 tons. The following table shows the output for each of the past five years:—

Year.	Madras.	Central Provinces.	Central India.	Total.
	Tons.	Tons.	Tons.	Tons.
1899	87,126	..	..	87,126
1900	92,458	35,356	..	127,814
1901	76,463	44,428	..	120,891
1902	68,171	89,608	..	157,779
1903	63,452	101,554	6,800	171,806

Mode of occurrence. Nāgpur area. In the Nāgpur area the manganese ore occurs as lenticular masses and bands in the quartzites, schists, and gneisses, and appears to have been formed, at least partly, by the alteration of rocks composed of manganese-garnet, with which the mineral rhodonite, a manganese-pyroxene, is often associated.

Dimensions of ore-bodies. The ore-bodies frequently attain great dimensions, and their disposition as irregular lenses along the strike of the enclosing schists naturally influences the miner in laying out the boundaries of his 'claims.' A deposit near Bālāghāt is 1¾ miles long; at Mānegaon in the Nāgpur District the ore-body is 1½ miles long; while at Thirori in the Bālāghāt District it is nearly 6 miles in length. As examples of great breadth may be quoted Kāndri, 100 feet thick, of pure ore; and Rāmdongri, 1,500 feet of ore and unaltered spessartite (manganese-garnet) rock. The depth of these ore-bodies is quite unknown, as the so-called mining has so far barely passed the quarrying stage, and the question of possible exhaustion does not enter into the calculations of the present owners.

Composition. The Nāgpur ore is typically a mixture of braunite and psilomelane, though it sometimes consists entirely of braunite—a hard, compact, pure ore, ranging well over 51 per cent. of manganese.

In the north-west part of Bhandāra District there are fourteen localities known to contain manganese ore, and a certain amount of work is in progress. In Bālāghāt District the ore has been found at ten places in the west of the District. Mining is being carried on near the town of Bālāghāt, and another large deposit occurs at Ukua in the Baihar *tahsīl*. In Chhindwāra manganese ore exists at eleven localities in the Sausar *tahsīl*, while it has long been known near Gosalpur and Sihorā in Jubbulpore District. The ore has also been reported from the Khairāgarh and Kālāhandī States. Distribution of manganese ore.

The deposits in the Central Provinces possibly belong to the same group of rocks which farther to the south-east were first worked for manganese ore in the Vizianagram estate; and the intermediate jungle-covered country, which is very little known, may yield further occurrences of the ore on more systematic exploration. In other parts of the Madras Presidency the ore has been discovered in the Kallikota estate in Ganjām District, and in the Sandūr hills of Bellary.

One deposit has been recorded in the State of Gwalior, and one is now being worked in Jhābuā, from which 6,800 tons were obtained in 1903, while there are several localities at which poor ores are found in the Dhār forest.

In the Bombay Presidency, manganese ores have been found at several places around Mahābaleshwar and Sātāra, in the southern part of Belgaum District, in Bijāpur, near Jambughora in Rewā Kāntha, and in Dhārwār District, where prospecting operations are in progress. Manganese has been also reported in the Tavoy and Mergui Districts of Southern Burma, in the Nizām's Dominions, and in the form of manganiferous iron ore near Chaibāsa in Chotā Nāgpur.

Chromite is known to occur with the peridotites of the 'chalk hills' near Salem, in the Andamans, and in Baluchistān. Attempts were made many years ago to work the deposits near Salem, but were not persisted in. In Baluchistān the ore occurring in the Pishīn and Zhob Districts is being extracted, the output for the first year of work (1903) being returned as 284 tons. Larger quantities are now being raised, the amount for the first half of 1904 being 1,816 tons. Chromium.

Cobalt ores have long been known and used in Rājputāna, where they are associated with nickel and copper ores near Khetri in the State of Jaipur. Nickel has been found to the extent of 1·84 per cent. in the pyrrhotite which occurs in the auriferous quartz veins of the Kolār gold-field. Cobalt and nickel.

Tungsten.

Wolfram occurs with tin ore in the alluvial deposits of Southern Burma and in the Southern Shan States, but no attempt to work it has been made hitherto.

Titanium and molybdenum.

Titanium occurs in ilmenite widely disseminated through some of the crystalline rocks of the Peninsula, but no case is known where the ore is sufficiently abundant for economic development. Molybdenum is found as isolated plates in pegmatite veins in parts of Chotā Nāgpur and at one place in Assam.

Aluminium.

Until recently the occurrence of bauxite in India was not definitely determined. It is now, however, established that many of the deposits of laterite, which are so abundant throughout the Peninsula and in Burma, contain large proportions of alumina in the form of hydrate, intimately mixed with the corresponding hydrates of iron, as in the substance known in Europe as bauxite, which is largely mined for the manufacture of aluminium. In addition to the laterites which are now in course of formation by the decomposition of aluminous rocks under the peculiar conditions of a tropical climate, there are remains of deposits formed in past geological ages; and so far as can be judged by the results of recent surveys, the quantity of this material in India suitable for the extraction of alumina, and hence for the manufacture of aluminium, is out of all proportion to the present demand. The economic development of these deposits must, however, await facilities for the extraction of the purified alumina in India, as the price of bauxite is too low to cover the cost of mining and subsequent transport to Europe and America.

Building stone.

If the extent of the use of building materials could be expressed by any recognized standard, it would form one of the best guides to the industrial development of a country. The attempt made to obtain returns of building stones, road-metal, and clays used in India was abandoned when it was shown, in 1899, that the returns could not possibly rank in value much above mere guesses.

In the absence of statistics, it is difficult to express shortly the trade in a material so widespread as common building stone. There are, however, a few features which are specially developed in, if not peculiar to, India. In the southern part of the Peninsula, various igneous rocks—the charnockite series near Madras, and the gneissose granites of North Arcot and Mysore—are largely used; in the centre, slates and limestones from the Cuddapah series, and basalt from the Deccan trap-flows, are quarried. In Central India, the Central and United

Provinces, the great Vindhyan system provides incomparable sandstones and limestones, while in Bengal and the Central Provinces the Gondwāna sandstones are used on and near the coal-fields. In the Narbadā valley the so-called coralline limestone of the Bāgh series forms an excellent building stone, with some claim to inclusion in the ornamental class. Among younger rocks, the Nummulitic limestones in the north-west and in Assam are largely quarried, while the foraminiferal Porbandar stone in Kāthiāwār is extensively used in Bombay and Karāchi.

The abundant development of concretionary carbonate of lime in the great alluvial plains, and the extensive development of laterite in the Peninsula and in Burma, are dependent, in their more pronounced forms, on conditions peculiar to tropical climates; and these two substances, the so-called *kankar* and laterite, are among the most valuable assets in building material possessed by the country.

The three great physical divisions of India, being the result of three distinct geological histories, show general contrasts in the materials available for simple as well as for ornamental building purposes. In the alluvial plains, buildings of importance are usually made of brick, but the surrounding tracts furnish a supply of stone, which is steadily increasing with improved facilities for transport. The monotonous line of brick and stucco buildings in Calcutta is now being relieved by the introduction of Vindhyan sandstones from Mirzāpur and the calcareous freestones and buff traps brought from the western coast. But the use of Italian marbles, mainly for floorings, and, in a smaller way, the introduction of polished granite columns and blocks from Aberdeen and Peterhead, still continue, mainly because these materials, which are no better than those of Indian origin, are placed on the market at cheap rates and in a manner suitable to the immediate requirements of the builder and architect.

During the past three years the building materials imported from foreign countries into India have had an average annual value of £174,970, of which £19,520 is due to imported stone and marble, and about £10,000 to marble alone. It is naturally surprising to find that a country which owes its reputation for architectural monuments as much to the fact that it possesses an unlimited supply of ornamental building stone as to the genius of its people, should depend on foreign supplies to the extent indicated by these import returns. It can hardly be an accident that each dynasty which has existed

in India since the wonderful Buddhist topes of Sānchī and Bhārhut were erected, has been marked by the erection of great monuments in stone, and there can be little doubt that the abundance of suitable material was an important contributory cause in the growth of India's reputation for architecture.

Besides the architectural remains left by the Buddhists, there are famous works in stone by the Hindus of the eighth to tenth century, including the great Dravidian temples of Southern India, mostly built of granites and other crystalline rocks, and the richly ornamented buildings of Orissa and Chānda, built of Gondwāna sandstones. The Pathāns and the Mughals utilized both the Vindhyan sandstones of Central India and the beds of marble in Rājputāna for building their magnificent mosques, palaces, and tombs in the cities of Northern India. It is only necessary to mention here Akbar's city of Fatehpur Sīkri, where the red and mottled sandstone of the Bhanrer series was used; and the famous Tāj, built mainly of white Makrāna marble, with elaborate inlaid work of yellow marble and shelly limestone from Jaisalmer, onyx marble from the Salt Range, black calcareous shales from the Vindhyans of Chitor, malachite from Jaipur, carnelians and blood-stones from the Deccan trap, and red jasper from the Gwalior (Bijāwar) series.

Limes and cements.

The subject of building materials includes lime and cement, which, obviously, are obtained from the most conveniently situated deposits of limestones, like those of the Vindhyan series, worked near Satnā in the Rewah State, and at Katnī in Jubbulpore District; or the various bands of crystalline limestones in Madras, Central India, and Rājputāna, and the Nummulitic limestones of Assam.

Kankar.

One of the most widespread and interesting sources of lime is the material generally known by the name of *kankar*. The commonest mode of occurrence is in the great alluvial deposits, in which the calcareous substances have segregated from the rest of the materials, and have grown into irregular lumps like flints in chalk, including in the concretions a certain amount of the argillaceous substances, which, when the *kankar* is burnt, is present in a proportion not far removed from that necessary to produce an hydraulic lime.

Brick, tile, and pottery materials.

There are few parts of India in which clay is not found in a character suitable for common bricks, tiles, and pottery; and in some places the finer varieties, such as those found near Jubbulpore and the so-called *Multāni-mitti* of the Bīkaner State, are used for the manufacture of the better grades of

pottery, which have acquired a considerable reputation for artistic merit. Pottery of various kinds is also made from the Gondwāna clays in the neighbourhood of Jubbulpore and at Rānīganj. Potash felspar, for use in pottery manufacture, is obtained from the numerous pegmatite veins in the Bengal crystalline areas.

Slate-quarrying gives a means of livelihood to numbers of workers along the outer Himālayas, where the foliated rocks, though often not true clay-slates, possess an even and perfect fissility, which enables them to be split for slabs and even fine roofing slates. In Kāngra District a joint-stock company has organized the work in a systematic manner, and has proved a financial success. The same company works quarries in clay-slate among the Arāvalli series near Rewāri, south of Delhi. Slate.

In the Kharakpur hills, a private company is working a slightly metamorphosed phyllite, which, though not giving the thinnest varieties of roofing slate, produces fine slabs for which a more extended use is continually being found. Slate is also worked in various parts of the so-called transition series of rocks of the Peninsula; but no figures are available to show the extent of the industry.

In India, where the use of corundum by the old *saikalgar* (armourer, sword-grinder) and lapidary has been known for many generations, the requirements of the country have been met from a few comparatively rich deposits; but it is doubtful if these are worth working for export in the face of competition in Europe and America, or can even hold their own against the importation of cheap abrasives. Corundum.

The ancient trade in Indian corundum still exists, but the returns for production are manifestly incomplete. No workings exist of the kind that could ordinarily be described as mining, though attempts have been made to increase the scale of operations at Pālakod and Pāparapatti in Salem District, near Hunsūr in Mysore, and in southern Rewah. In 1898 the returns showed a production of 7,603 cwt., but the output has not approached this figure in any subsequent year.

The manufacture of millstones is almost universal in India, any hard stone found locally being turned to account. In the plains small millstones of about 15 inches in diameter are worked by hand; but in the Himālayas, where a fall of water can be easily obtained, a rude form of turbine is made to work a heavier stone by a direct-acting vertical shaft, and the ordinary meal of the hill-man is ground in this way. These Millstones.

small mills are familiar objects in a Himālayan valley, but no returns are available to gauge the industry of stone-cutting.

Mineral pigments.

Up to the present the manufacture of mineral paints seems very small in proportion to the demand and the natural resources in minerals apparently suitable. In Jubbulpore District mineral paint-works are utilizing the soft hematites of Jauli and are drawing supplies of yellow ochre from the Pannā State, while similar works near Calcutta depend largely on imported material.

Ochres, red, yellow, and other colours, are commonly used by natives in many parts of the country, in a crude or simply levigated form under the generic name *geru*. A common source of supply is laterite in the Peninsula and in Burma, but well-defined ochres occur in deposits of various geological ages down to the Archaean hematites. In Trichinopoly District yellow ochre is obtained from the Cretaceous rocks, and in Burma large deposits are known among the Tertiary beds of Myingyan District. A black slate near Kishangarh has been successfully tried on the Rājputāna-Mālwā Railway. Barytes, used as a substitute or adulterant for 'white lead,' is obtainable in quantity near Alangayam in Salem District and in Jubbulpore District, but no attempts have been made to turn these deposits to account for paint-making.

Orpiment, the yellow sulphide of arsenic, is largely imported into Burma from Western China for use mainly as a pigment. During the six years 1897–8 to 1902–3, the average annual imports across this frontier amounted to 9,551 cwt., with an estimated value of £11,470. In addition to orpiment there is a considerable trade in other compounds of arsenic. The annual export of Indian arsenic to the Straits Settlements exceeds 300 cwt., and about 2,300 cwt. are imported from Europe for use in India.

Refractory materials. Mica.

India has for many years been the leading producer of mica, turning out more than half the world's supply. During the past three years the average annual value of mica exported to Europe and America has been £78,888, with an average value of a little more than £4 per cwt. About 77 per cent. of the mineral exported goes to the United Kingdom, which is, however, largely a centre of distribution to the United States and Germany. In addition to the higher grades exported, large quantities of scrap mica are consumed in the country for ornamental purposes.

Export of films for micanite.

In 1898 the Indian mica miners began to realize that their waste dumps contained a large supply of the material required

for the manufacture of micanite, in which thin films of mica are cemented together and moulded into sheets, to serve many purposes for which only the natural sheets were formerly used. The waste heaps were consequently examined, and the clear sheets of muscovite were cleaned and split into thin films by gangs of children, who, by practice, can select the films of the required thickness with an accuracy that could only be exceeded by the use of a micrometer. The large quantities of 'flimsy' mica thus suddenly thrown on to the market raised the weight of mica exported, without a corresponding increase of value. The average value of the mica exported in 1897 was £6·4 per cwt.; in 1899 the value dropped to £3·25, but after 1900 rose again to £4·3 per cwt.

The mica raised in India belongs entirely to the variety known as muscovite, which occurs in large pegmatite veins traversing mica-schists in various parts of the Peninsula. The two principal areas of production are the Nellore District of Madras, and a belt of ground, 12 miles broad and about 60 miles long, stretching obliquely across the junctions of the Gayā, Hazāribāgh, and Monghyr Districts in Bengal.

Mica-mining.

In the latter area the industry has been in existence for many years, while in Nellore mining commenced as recently as 1892. The mines in Bengal are still worked on a plan which is but a degree in advance of that followed by the native workers of the past. The mica, generally discovered at the exposed outcrop of a pegmatite vein on a hill-face, is followed from 'book' to 'book' by underhand stoping, which results in the production of tortuous, worm-like holes, sometimes extending to depths of 300 feet below the surface. The whole material excavated, consisting of mica, rubbish, and underground water, is brought to the surface by a string of coolies working hand over hand on rudely constructed bamboo ladders. On account of the accumulation of water during the night, when work ceases, all sinking operations are delayed each morning for an hour or more while the operation of baling out the water is in progress, and during the monsoon mining is completely stopped by water for about three months. Apparently the occurrence of the mica-bearing pegmatites in sheets, with a fairly uniform dip and strike, has not been noticed by the miners, who have consequently been content to work the material in sight at an expensive rate rather than undertake operations for mining on the systematic plan now adopted for all bedded minerals.

That mica-mining has yielded large profits with such primitive

and wasteful methods affords strong presumptive evidence of the value of the deposits, but the time is fast approaching when a better system will become necessary for profitable exploitation of the remaining veins which contain smaller proportions of the large and valuable sheets of mica.

In Nellore District the pegmatite veins are exposed in open quarries, which are naturally limited in depth by the instability of the rocks forming the sides of the quarries, and by the accumulation of large heaps of rubbish in the immediate vicinity of the workings.

Asbestos. Asbestos has not yet passed beyond the prospecting stage in India, although attempts have been made during the past three or four years to work it in Merwāra in Rājputāna, Garhwāl in the United Provinces, and Hassan in Mysore.

Steatite. One of the most widely distributed minerals in India is steatite, either in the form of a coarse potstone—so called on account of its general use in making pots, dishes, &c.—or in the more compact form suitable for carvings, and in its best form suitable for the manufacture of gas-burners. There is a trade of undetermined value in nearly every Province, but it is impossible to form even a rough estimate of its extent. An exhaustive account of the Indian deposits of steatite was published by Mr. F. R. Mallet in the *Records, Geological Survey of India*, vol. xxii, part 2 (1889), and a note by Mr. H. H. Hayden in vol. xxix (p. 71) of the same publication adds further details with regard to its existence in the Minbu District of Burma.

Magnesite. In Southern India there are numerous occurrences of the ultra-basic igneous rocks in which olivine is an abundant constituent, and at several places these highly magnesian silicates have been decomposed, magnesite of great purity being formed. The largest and best known of these is near Salem, where the area occupied by the white magnesite veins has been named the 'chalk' hills.

Prospecting operations have been in progress in this area for some years, but the industry may now be described as having passed into the mining stage; and on account of the remarkable purity of the mineral raised it is expected to command a special price for the preparation of the refractory bricks used for the linings and hearths of steel furnaces, and for lining the fire-bricks of the electric calcium-carbide furnace. The production so far has been small—amounting to 3,540 tons in 1902 and 825 tons in 1903—but work is now being organized on a larger scale.

In Bihār, which is the chief source of saltpetre in India, the conditions for the natural production of the compound closely approach the theoretical ideal. With a population exceeding 500 per square mile, where agriculture is the chief occupation, and where consequently the people are accompanied by a high proportion of domestic animals, there is an abundant supply of organic nitrogen to the soils around villages. With a mean temperature of 78° F., confined to an annual range of 68°, and for a large part of the year, when the air has a humidity of over 80 per cent., with a diurnal range not exceeding 8° above or below 84° F., the conditions are unusually favourable for the growth of so-called nitrifying bacteria, which convert ammonia by successive stages into nitrous and nitric acid. Wood and cowdung are largely used for fuel, and the immediate vicinity of each village thus forms a perfect laboratory for the formation of potassium nitrate. In the long period of continuous surface desiccation, which follows a small monsoon rainfall, the compounds so formed in the soil are brought to the surface by capillary action, and appear as a white efflorescence of dried salts which is collected and purified for export as saltpetre.

Materials used for agriculture, chemical industries, and food. Saltpetre.

So long as potassium nitrate formed an essential constituent of the only explosive used in large quantities, and until the discovery of large deposits of sodium nitrate in Chili, the saltpetre production of India added to the political importance of the country, and the great fluctuations in the price of the salt gave rise to heavy speculation during periods of international complications. The Indian supply is now, however, no longer essential to the chemical industries of Europe, though the cost of manufacture and transport is sufficiently low to maintain the export trade at a fairly uniform level of about 20,000 tons a year, with an average value of £262,000. Of the total exports, 80 per cent. is divided between the United Kingdom, Hong Kong, and the United States, and 98·5 per cent. of the total leaves India by the port of Calcutta.

Phosphates.

One regrettable feature in connexion with the Indian mineral resources is the absence, in a country where agriculture is such a predominant industry, of any phosphatic deposits of value; and a further circumstance to be deplored is the export of phosphates in the form of bones, due primarily to the fact that, the country being without the means for the manufacture of cheap sulphuric acid, superphosphate is not made and the small quantity used is imported from Europe. During the past six years the materials imported under the

head of manures have varied in value from £6,367 in 1898–9 to £2,144 in 1902–3, while the exports of bones amount to just 100,000 tons a year, valued at £350,000.

Among the phosphatic deposits of India, perhaps the only one worth considering is the deposit of phosphatic nodules of the septarian kind, occurring in the Cretaceous beds of the Perambalūr *tāluk*, Trichinopoly District, Madras. Two attempts made to dispose of these phosphates in a finely powdered condition for use as a fertilizer on coffee plantations in Southern India were, however, reported to be unprofitable, and consequently mining leases have not been applied for.

Small quantities of apatite are turned out and thrown away with the waste in the Hazāribāgh and Nellore mica-mining areas, and a few other occurrences of unknown, and presumably smaller, value occur at different places—near Mussoorie, in Eastern Berār, and in the eocene shales above the coal near the Dandot colliery in the Punjab Salt Range.

Potash salts.

Potash salts have been found associated with the rock-salt deposits in one locality only in the Mayo mine of the Salt Range, where a lenticular band, with a maximum thickness of 6 feet, was discovered in 1873, and proved to be composed largely of the mineral sylvine, or potassium chloride.

Gypsum.

Gypsum is found in considerable abundance in various parts of India, both in the fibrous form and in clear selenite crystals. In Sind it occurs in beds sometimes 3 to 4 feet thick near the top of the Gāj formations of the Kirthar range; in Cutch it abounds in the rocks below the Nummulitic limestones; in the Salt Range it exists in large masses with the salt-marl, lying below Cambrian beds. A very interesting and, judging by the returns, important occurrence is NNW. of Nāgaur, in Jodhpur, Rājputāna, where a bed, 5 feet thick or more, has been discovered in silt probably formed in an old salt-lake. From this area an annual average output of 5,394 tons is reported for the years 1898 to 1903. Selenite crystals of similar origin have been found recently in the *kankar* near the base of the silt in the Sāmbhar Lake.

Alum.

The separation of the sulphate of alumina from decomposed pyritous shales, and the preparation of the double sulphate of alumina and potash, by the introduction of nitre or wood-ashes, was formerly an important industry in a few places, and was carried on to a smaller extent at numerous places in India. But the importation of cheap alum, principally from the United Kingdom, and its wide distribution by the gradually extending railway transport have now almost extinguished the native

industry. During the past six years the consumption of foreign alum in India has averaged 66,086 cwt. a year. No returns are available to show the amount of production in India. Near Kālābāgh on the Indus, considerable quantities of a pyritous shale are extracted for this purpose; but the mining is carried on in an irregular, fitful way, and the returns are probably rough estimates. In 1898 the output was reported to amount to 750 tons, valued at £3,150, but no returns are available for 1899, 1900, and 1903. In 1901 and 1902 the production was reported to be 98 and 112½ tons respectively.

Small quantities of sulphur are obtainable on the volcano of Barren Island, and on some of the volcanoes in Western Baluchistān, while sulphur has been reported in connexion with the petroliferous Tertiary rocks in the Baluchistān-Persian belt, as well as in the Arakan system on the east. No deposits of free sulphur are, however, known to be worth working. Sulphur.

Pyrite occurs in various parts of India, and in one place, near Kālābāgh on the Indus, it is sufficiently abundant in the shales which are worked for alum to give rise to frequent cases of spontaneous combustion. An instance of this sort, if suitably placed, might be of value as a source of sulphur, but at present the possibility of successful competition with the imported article seems to depend on the problem of working the metalliferous sulphides for both metal and sulphur.

For many years pyritous deposits in India have been used for the manufacture of soluble sulphates of iron and copper. The case of alum has already been referred to; and with the alum which was formerly procured in quantity from the decomposed pyritous shales at Khetri and Singhāna in Rājputāna, copperas and blue vitriol were also obtained. No statistics are, however, available with regard to these industries, which have given way before the importation of cheap chemicals from Europe. Sulphates of iron and copper.

Borax is not produced within British India, but is obtained from the Puga valley of Ladākh in Kashmīr, and from Tibet. In the Puga valley the mineral is deposited from hot springs, associated with sulphur deposits, which probably represent the final phase of declining volcanic action. The industry has undergone a very serious decline during the last few years, on account of the discovery of large deposits of calcium borate in various parts of North and South America. The comparatively large export trade to the United Kingdom, which existed twenty years ago, has practically disappeared, and Borax.

most of the borax now sent out through India is sold in the Straits and in China.

During the past six years the imports of borax across the frontier into India have averaged 21,955 cwt. a year, of which 4,481 cwt. were sent out of the country. Twenty years ago the borax exported through India amounted to more than 16,000 cwt. a year, valued at £24,000.

Soda salts. The only other salts of the alkalies deserving mention are the carbonate and the sulphate of soda, known generally as *sajjī* and *khāri* respectively. Both salts are obtained from the soil in various parts of the country, and both are prominent constituents of the efflorescence known as *reh* which renders large areas quite sterile. Carbonate of soda occurs in quantity in the water of the crater-like Lonār Lake, which forms a roughly circular depression in the Deccan trap-flows of Berār.

There was formerly a considerable production of both salts for consumption in India, but the native material is now being displaced by the cheap supplies of chemically manufactured material obtained from Europe. The carbonate of soda imported from Europe during the past five years has averaged 59,000 cwt. per annum, valued at £24,000, and there is a general tendency for the imports to increase with the gradual reduction in the cost of the manufactured article in centres of chemical industry.

Salt. On account of the long-continued periods of dry and hot weather in the Indian Peninsula, the manufacture of salt by the solar evaporation of sea-water is possible on a scale sufficient to meet a large proportion of the requirements of the areas within short distances of the coast. Of the total amount of salt consumed in India, amounting on an average to 1,400,000 tons a year, about 600,000 tons, or 44 per cent., are manufactured from sea-water, while 435,000 tons are imported, and the rest is obtained by mining in rock-salt deposits, and by the evaporation of brine occurring in the subsoil of arid regions, or in lakes formed in areas of internal drainage.

Rock-salt. Deposits of rock-salt are confined to the Punjab and the North-West Frontier Province, where the mineral is raised by mining, as in the cis-Indus part of the Salt Range in Jhelum and Shāhpur Districts, or by open quarry work, as at Kālābāgh on the right bank of the Indus, near Kohāt on the frontier, and at Guma and Drang in the Mandi State. The rock-salt thus raised in India amounts to about 110,000 tons

a year, which is 11·2 per cent. of the average annual production of the country.

Salt Range. Of this production of rock-salt, 89,000 tons, or 81·2 per cent., are obtained from the Mayo mines near Khewra (32° 39′ N.; 73° 3′ E.) in the Salt Range, where the mines have been worked since the days of Akbar, and for an unknown period before his reign. The salt-mining in this area came under British control with the occupation of the Punjab in 1849, and the plan of systematic operations now followed in the Mayo mines was organized in 1872. The salt-deposits in this area have an aggregate thickness of 550 feet, of which five seams of very pure material make up 275 feet, while the other half, known as *kallar*, is too earthy and impure to be marketable.

Kohāt rock-salt. The Kohāt salt is generally grey in colour, and is thus easily distinguished from that raised in the Salt Range, where the prevailing colour is pink or light-red. The masses of rock-salt exposed in the Kohāt area are, at the present rate of quarrying, practically inexhaustible. In the anticline at Bahādur Khel, where the salt is exposed at the base of the Tertiary system of rocks, the beds of salt can be traced for a distance of about 8 miles, with an exposed thickness of over 1,000 feet.

Mandi rock-salt. In the State of Mandi, the rock-salt beds occur near the faulted junction of the Tertiary rocks and an older unfossiliferous series of unknown age, and two exposures, at Drang and at Guma, are worked in open quarries. The average annual output of the Mandi quarries amounts to less than 5,000 tons of very impure material, in which the percentage of available sodic chloride is seldom more than 70 per cent.

Sāmbhar Lake. The most important source of the salt formed in regions of internal drainage is the Sāmbhar Lake in Rājputāna. The lake fills with the inflow of every monsoon, forming a sheet of water 60 to 70 square miles in area, and 2 to 4 feet in depth. The water enters with small quantities of salt in solution, but takes up larger quantities from the mass of silt forming the bed of the lake, where the salt brought in by the rivers has been accumulating for an unknown length of time. Within two or three months after the close of the monsoon the lake-water is found to have absorbed sufficient salt to make a strong brine, and from this the salt is obtained by solar evaporation in specially constructed enclosures.

Since the Sāmbhar Lake came under the direct control of the British administration in 1870 the salt removed has amounted to a little over 4,000,000 tons, and the present

rate of extraction is 135,000 tons a year. The most abundant of the soluble salts associated with the sodium chloride in the lake silt are sodium sulphate and sodium carbonate. The proportionate increase of these compounds by the continued removal of almost pure sodic chloride will interfere with the manufacture of a pure salt long before there is any appreciable diminution of the great stores accumulated in the lake mud, and the question of the economic limits of this source is now being carefully investigated.

Gem-stones.

The only precious and semi-precious stones at present mined in India are the diamond, ruby, sapphire, spinel, tourmaline, garnet, rock-crystal, and the various chalcedonic forms of silica, jadeite, and amber. Amber has already been referred to among the carbon compounds, and of the rest only the ruby and jadeite attain any considerable value in production. For turquoise India is merely the channel through which the mineral obtained beyond the northern and north-western frontier is distributed. The value of unset precious stones and pearls imported into the country is increasing, and reached the high figure of £988,000 in 1903.

Diamond.

Notwithstanding the reputation (stretching back as far as Ptolemy in the European, and farther in the Hindu, classics) which India enjoys as a diamond-producing country, the output of to-day is very small and comparatively unimportant. The places which, according to historical accounts, have been most productive in the past form three great groups, each in association with the old unfossiliferous rocks of probably pre-Cambrian age now known as the Purāna group, and distinguished locally as the Cuddapah and Kurnool systems in Southern India, and the Vindhyan system in the northern part of the Peninsula.

The most southern of the three groups includes localities, with apparently authentic records, in the Madras Districts of Cuddapah, Anantapur, Bellary, Kurnool, Guntūr, Kistna, and Godāvari. Besides the stones picked up on the surface, or found in deposits of alluvium, workings have been undertaken in the so-called Banganapalle stage of the Kurnool series of strata.

In the second group in the Mahānadī valley, the stones have been found in the alluvium in the Sambalpur and Chānda Districts of the Central Provinces; but though strata similar to those of the Vindhyans and Kurnools are known in this area, no diamonds have been found in these older rocks.

The third group occupies a tract some 60 miles long by 10 miles wide, with the Vindhyan conglomerates near

Pannā (Central India) as the centre. The diamond-mining industry still persists in this area, both in the old conglomerate of Vindhyan age, and in deposits which, though described as alluvium, are possibly relics of Lameta (Upper Cretaceous) deposits.

During the past six years the ruby-mining industry in Upper Burma has undergone a favourable change, the stone having now become, next to petroleum, the most profitable source of revenue among Burmese minerals. Various leases have been granted in the ruby-bearing area near Nanyaseik in Myitkyinā District, and in the 'stone-tract' of the Sagyin hills, in Mandalay District; but the results have been generally profitless. The returns for the Mogok area, however, where the Burma Ruby Mines Company is paramount, show that the industry has entered a most encouraging stage. The company obtained the right in 1889 to mine for rubies, and to levy royalties from persons working by native methods, the lease being renewed in 1896 for fourteen years, at a rent of Rs. 3,15,000 a year, *plus* a share of the profits. The results being, however, unsatisfactory from the shareholders' point of view, the rent was reduced in 1899 to Rs. 2,00,000, the share of the profits being, at the same time, raised from 20 to 30 per cent. The value of the rubies obtained by the company has ranged from £58,000 in 1898 to £104,000 in 1901, while the average for six years ending 1903 was £89,000. In 1899 three unusually valuable stones were found, one of 77 carats being valued at 4 lakhs of rupees (£26,666). Ruby.

Sapphires of considerable value were formerly obtained in Zanskār, Kashmīr State, but the mines are said to be exhausted, and returns for recent work are not available. Occasionally the normal blue sapphire, and the rarer green, yellow, and white varieties, are found in the ruby-bearing gravels in Burma. Sapphire

Spinel is a constant associate of the ruby, both in the gravels and in the limestone; and the crystals, on account of their perfect ruby colour and their octahedral habit, are often mistaken for the true ruby, which combines the basal plane and rhombohedron. Spinel.

Beryl of pale-coloured varieties occurs commonly in the granite-pegmatites of India, but the crystals are generally too much fissured for use as gem-stones. Occasionally in the pegmatite veins which are worked for mica in Hazāribāgh and in Nellore, large crystals of beryl, many inches across, are found to include clear fragments which might be cut as aquamarines; Beryl.

but the only places in India where attempts have been made to excavate pegmatite solely for its aquamarines are at Padyūr (Pattalai) near Kāngayam, Coimbatore District, and at different places in the Toda hills in Rājputāna. Stones of considerable value have been obtained from the mine which was worked at Padyūr in the early part of the nineteenth century: a pit 30–40 feet in depth is still in existence, but no one seems to have taken an interest in the place since 1818. The whole area is impregnated with igneous intrusions, and deserves more attention than it has so far received.

Tourmaline.

Several attempts have been made to work the beautiful red variety of tourmaline (rubellite) which occurs in the Ruby Mines District of Upper Burma. In 1898 an out-turn worth £359 was reported for this area; in 1900 the value was estimated at £1,240, and in 1903 at £196, but returns are not available for intermediate years. The blue, green, and black varieties of tourmaline occur in the mica-bearing pegmatites of Hazāribāgh District.

Garnet.

The only garnets worked to any considerable extent in India occur in the mica schists of Rājmahal in Jaipur, and near Sarwār in the adjoining State of Kishangarh. Returns are not available to show the condition of the industry in the Jaipur State; but there is still a considerable industry in Kishangarh, though the yearly estimates, ranging from about £10,000 to £2,000, are too variable to permit of a fair average being drawn.

Rock-crystal.

In the Tanjore District of Madras, fragments of rock-crystals are collected and cut for cheap jewellery, being known as 'Vallam diamonds,' while the bi-pyramidal quartz crystals found in the gypsum of the salt marl near Kālābāgh, on the Indus, are used for making necklaces.

Chalcedonic silica.

There is still a considerable trade in agate and the related forms of silica, known under the general name of *hakik*, which are obtained from the amygdaloidal flows of the Deccan trap. The best known and perhaps still the most important of the places at which agate and carnelians are cut and prepared for the market is Cambay, the chief city of the State of that name under the Kaira Political Agency, Bombay Presidency. The agates come from various tracts on or near the edge of the trap, but mostly from the State of Rājpīpla, where the chief source is a conglomerate near the village of Ratanpur. The right to collect *hakik* at Ratanpur is leased for a period of five years at a fixed rental, but precise data as to the value of the stones sent to Cambay are not obtainable. A certain

amount of agate-cutting is also carried on at Jubbulpore, and a few other places within range of the Deccan trap. Much of the agate sold in Europe is sent from Cambay, and large quantities are also exported to China.

During the past six years the jadeite raised in Upper Burma, and exported *via* Rangoon to the Straits and China, has averaged 3,911 cwt. per annum, valued at £44,770. The industry is thus an important one, and ranks in value next to rubies among the mineral products of Burma. Some jadeite, and often the best material, is obtained as pebbles in the gravels of the Uyu river, a tributary of the Chindwin; but most of it is obtained by quarrying near Tammaw (25° 44′ N.; 96° 14′ E.) in the Mogaung subdivision of Myitkyinā District, Upper Burma. In this locality the jadeite forms a layer in the dark-green serpentine, against which, on a fresh surface, it stands in striking contrast on account of its lighter colour. The serpentine is apparently intrusive into miocene sandstones, and the jadeite must have been separated as a primary segregation from the magma. The prices paid for rough stones vary too greatly to permit of quotation, but the export values declared give an average of £11 9*s.* per cwt. during the last six years. Jadeite.

Except in connexion with the quarrying of building stone, and the manufacture of bricks, tiles, and pottery, for which no precise statistics are available, the recent developments in Indian mining have been necessarily local in their effects on the population. In connexion with the mining industries for which returns are available, the average total number of workers employed daily exceeds 150,000; of these more than 90,000 are employed in coal-mining, more than 27,000 on the Kolār gold-field, about 9,000 in mica-mining, and 7,000 in quarrying manganese ore. Labour.

From the point of view of labour, therefore, coal-mining is most important; and in those parts of Bengal from which the chief supplies of coal are obtained the changes in the population of certain revenue areas since the Census of 1891 have been remarkable. The Census of 1901 showed that in the Gīrīdīh subdivision of Hazāribāgh District there had been an increase of 4·0 per cent., part of which, in the Ganwan and Kodarmā *thānas*, was due to mica-mining, while in the Gīrīdīh *thāna* alone the increase in ten years was 8·8 per cent. In the Gobindpur subdivision of Mānbhūm District, which includes much of the Jherriā coal-field, the increase of population between 1891 and 1901 was 25·1 per cent., while in the Effect of coal-mining on the population.

Jherriā *thāna* alone the increase was 75·1 per cent., and in the adjoining *thāna* of Topchānchi 30·2 per cent.

Source of the colliers.

The majority of the workers, or about 82 per cent., are employed in the Bengal mines, where the bulk of the colliers belong to the *kamia* class of landless day-labourers, though some are agriculturists holding lands at a distance from the coal-fields, necessitating periodical migrations to attend to their own crops. In some of the long-established mining centres a population is being evolved wholly devoted to mining, which they now regard as their caste occupation. To this class allotments of land are sometimes made on a system which adds to the contentment of the miner, and the consequent stability of the industrial system.

A considerable proportion of the colliers are aboriginal Santāls, Mundās, Oraons, Kols, and Gonds, the rest being semi-Hinduized low castes, among whom communities of Bauris, who are normally pālki-bearers and cultivators, have been cutting coal for so many generations that they now regard it as the special function of their caste. Large numbers of so-called *pardesi* labourers are brought from the United Provinces for work in Bengal, the Central Provinces, and at Singareni. The labour in the Assam coal-mines is imported under the regulations governing the cooly immigration to the tea-gardens in the same Province; the workers are mainly of the same origin as those employed in Bengal. In Baluchistān the miners come from the Makrān coast, Sind, and Afghānistān.

Average output by Indian colliers.

It will not be surprising to those who know the habits of the Indian cooly to learn that the output of coal per person employed is lower than in any part of the British Empire, except in Cape Colony, where cheap native labour is largely employed. The average output per person employed in Indian coal-mines was 70 tons in 1901, and 75 tons in 1902; for the rest of the British Empire the averages for the same years were respectively 281 and 285 tons. In 1903 the average in India rose to 84 tons per head.

The output varies with the system of work observed, modified by the difficulties of the ground. In Bengal the collier turns out on an average 72 to 75 tons of coal a year; at Warorā the output is as high as 132 tons; at Dandot in the Salt Range the average has decreased from 51 tons in 1899 to 31 tons in 1903, while at Khost in Baluchistān it is 45 tons.

Hours of work and wages.

In the collieries of the Central Provinces, definite 'shifts' are observed, but in most of the Bengal mines the miners choose their own hours. They seldom think it necessary to

work for more than five days a week, and reduce the year's total still further by the observance of many feast-days. At most of the mines, underground work is undertaken by gangs or families at a fixed price per 'tub' of coal. The coal-cutters are invariably men, but the women and children of a family carry the coal to the tubs, and push the tubs to the shaft or incline. The coal-cutters in Bengal can earn from 8 to 12 annas a day for underground work, while unskilled labourers on the surface earn only 3 to 4 annas a day. Women may earn from 1 to 2 annas, and as a result of this high total income of a family there is a general rise of labour rates around all mining centres.

The almost universal practice in Indian coal-mines is to extract the coal on the system variously known as 'bord and pillar,' 'post and stall,' or 'stoop and room.' Although this system in Europe is fast being superseded by the more economical 'long-wall' method, yet, owing to the thickness of most of the Indian seams, it is not easy to devise any more suitable plan of working. It is undoubtedly wasteful, for the pillars form from 25 to 65 per cent. of the available coal; and at the present time, except in certain mines, where trained labour and efficient supervision are possible, their extraction is not even contemplated. Coal-mining methods.

The strong roof so frequently found in the mines worked in Gondwāna rocks, which is due not only to the intrinsic strength of the rocks, but to the remarkable freedom from geotectonic disturbances on the Peninsula, adds a feature of safety not at once fully appreciated by those who have gained their experience in countries without these advantages, or where the galleries are subject to the stresses of a greater overburden.

In the Mākum field a highly inclined seam, 75 feet thick, is worked on a modification of the South Staffordshire system of 'square work.' The coal is removed in two, or sometimes three, sections, the top section being removed first and a parting of stone and coal being left untouched between each pair of sections. In the Dandot and Khost mines, thin seams are worked in one operation on a modified 'long-wall' system.

Electric lighting, electric blasting, and electric coal-cutting machines are now being introduced into some of the Bengal mines. In a very few mines safety-lamps are used, but in the great majority no appreciable quantities of fire-damp are found.

An important consideration, naturally, in every mining community is the risk to life involved in what has been generally classed as a 'dangerous' occupation. As far as the industry Death-rate from mining accidents.

has progressed, the record is distinctly satisfactory. There has been not only a very low death-rate from isolated accidents in Indian coal-mines, but at the same time a general absence of those disasters which have caused European communities to impose legislation for the protection of the miner.

During the past six years the death-rate from accidents at Indian collieries has averaged 0·88 per thousand persons employed, while the yearly rate has varied between 0·68 and 1·32. The death-rate in India is thus slightly more than half the rate in the United Kingdom, and almost exactly half of the average for the British Empire, which was 1·53 in 1901 and 1·54 in 1902. It also compares favourably with the rates in the principal foreign coal-mining countries. In Austria the rates for 1901 and 1902 were 1·39 and 1·60 per thousand respectively; in Germany 2·22 and 1·93; in Belgium 1·02 and 1·07; in France 1·21 and 1·09; in Holland 1·47 and 1·27; and in the United States 3·10 and 3·25.

Death-rate compared with coal production.

The death-rate per thousand employed does not, however, fairly show the cost in lives of the coal obtained; and the Indian returns, calculated on this basis, give a less favourable result than the average for the rest of the Empire. The only country with which the Indian results can be directly compared is Cape Colony, where the output per person employed varies between 71 and 75 tons per annum, and the loss of life per million tons of coal raised is about twice as great as in India.

Death-rate from accidents on the Kolār gold-fields.

The vital statistics for gold and mica mines in India are slightly less satisfactory. The average death-rate on the Kolār gold-field during the past six years has been 2·43 per thousand persons employed, 13·67 per million tons of ore raised, and 3·13 for every hundred thousand pounds worth of gold recovered.

Death-rate from accidents at mica mines.

At the mica mines the death-rate from accidents, for an average employment of 9,165 workers during the three years since the mines have come under the Indian Mines Act, has been 1·05 per thousand; but the results are not sufficiently uniform to permit of a general conclusion as to the risk to life in mica-mining, for out of a total of twenty-nine deaths for the whole period of three years, sixteen occurred in Nellore District in 1901.

Legislation.

In consequence of the growth of the mining industry, and the rapidly increasing employment of labour, arrangements were made by Government in 1894 for the preliminary inspection of the chief mining areas, and as the outcome of the data so obtained it was decided in 1901 to pass an Act for the

regulation and inspection of mines. According to the Indian Mines Act VIII of 1901, all mining operations to a greater depth than 20 feet below the surface are liable to examination by a duly qualified Inspector, and provision is made for the appointment of local mining boards and committees to inquire into cases of accidents or dangers considered by the Inspectors to be the result of mismanagement. Provision is also made in the Act for the framing of rules to regulate the duties of the Inspectors, to prescribe the duties of owners, agents, and managers, to prescribe the qualifications of managers, to arrange for regular returns of statistics and plans, and to draw up the usual regulations for safeguarding the miners.

BIBLIOGRAPHY

V. Ball.—*Economic Geology of India* (Calcutta, 1881), Second Edition, revised by the Director, Geological Survey of India, 1905.

T. H. Holland.—'Review of the Mineral Production of India for the years 1898–1903,' *Records, Geological Survey of India*, Vol. xxxii, Pt. 1 (1905).

CHAPTER IV

ARTS AND MANUFACTURES

I. Introductory

Progress of India as a manufacturing country.

THOUGH India is pre-eminently an agricultural country, the advance of other industries may be inferred from the circumstance that for many years past the returns of foreign trade have shown a steady expansion in the exports of manufactured goods and in the imports of raw materials. In the fifteen years ending with March, 1904, the increase amounted to 101 per cent. under exports, and 45 per cent. under imports, while the exports of Indian raw produce increased by only 28 per cent., and the imports of foreign manufactures by only 17 per cent. India is thus working up more and more of her own raw materials, and is finding an expanding foreign market for her manufactures. At the same time she requires a larger amount of imported raw products to feed her mills, factories, and workshops.

Hand and steam industries.

The arts and manufactures of India are more easily separable into sections, corresponding with hand-labour and steam-power, than are those of most countries; for handicrafts, in spite of the marvellous mechanical developments of the past century, are still very important to the Indian people. The carpenter, the potter, the blacksmith, the stonemason, the weaver, the dyer, the tailor, the shoemaker, the drug-seller, and the sweetmeat-maker are recognized members of most village communities. The higher crafts—those of artistic workers in wood, clay, stone, metals, and textiles—are carried on in special localities and in direct relationship to physical and administrative conditions. When, for instance, hand-labour industries are practised on a large scale they tend to become centralized in the important towns.

Steam-power manufactures are not in any way indigenous industries, but have been originated, and are controlled, by the supply of raw material and fuel, by the facilities of transport, and by the degree of association with European enterprise.

It is impossible to enter into an elaborate dissertation, interesting as the subject would be, on the influence of religion and racial characteristics upon the crafts. The caste system is probably a less potent factor than might at first be supposed. Castes are very rarely trade guilds: in fact, an exact parallel to the guilds of Europe can hardly be said to exist, perhaps never did exist, in India.[1] The same caste may embrace several crafts, and, as a rule, Muhammadans and Hindus engage in the same trade, each working for his own community. Sometimes they take recognizable sections of a craft and work separately. At other times they may be found in the same workshop; and Hindus now often employ Muhammadan craftsmen, whereas formerly the Hindus were the labourers and the Muhammadans the employers. Taking, therefore, a wider conception than that of caste or even craft, the communities concerned in the arts and manufactures of India may be grouped as follows, according as they are engaged in—

The communities concerned in Indian arts and manufactures.

(1) Rural industries, directly associated with agriculture or agricultural produce.

(2) Manufacturing and urban occupations—the textile industries proper.

(3) Sylvan occupations—the collection or utilization of natural or wild products.

(4) Occupations connected with mines and metals.

Under each of these four groups both skilled and unskilled labour find their place. The wild products assume in India a greater importance than in most countries, on account of their aggregate value, and also because of the employment they afford to the poorer communities of the inhospitable tracts in which they are, for the most part, found.

India may be divided into five great industrial areas, which are enumerated below along with their more important commercial and artistic productions.

Local distribution of industries.

Bengal and Assam. *Commercial.* India-rubber, oilseeds and oil, lac, indigo, jute, paper, hides and skins, silk, opium, tobacco, tea, sugar, rice, gram, coal, iron, saltpetre, mica, pottery. *Artistic and Minor.* Ivory-carving, umbrella-making, shell-carving, Dacca muslins, embroidery, mat-making.

Northern India (the United and Central Provinces, Rājputāna and Central India, the Punjab and the Frontier Pro-

[1] The nearest approach is found in the caste associations in some of the towns of Western India.

vince, and Kashmir). *Commercial.* Resin, lac, oilseeds, perfumery, soap and candles, cutch, myrabolams, cotton, silk, wool, leather, carpets and mats, wheat, flour, biscuits, opium, tea, sugar, beer and spirits, *shīsham* and *deodār* (cedar) woods, barilla, borax, lead, copper, gypsum, salt, saltpetre. *Artistic and Minor.* Tinned ware, lac-coloured metal ware, enamels, gold and silver plate, damascened ware, encrusted ware, copper and brass ware, stone-carving and lapidary work, pottery, wood-carving, inlaid woodwork, lattice-work, painted wood and papier mâché, ivory-carving, leather and skin work (belts, flasks, &c.), lac-ware, dyeing and calico-printing, tie-dyeing, cotton manufactures, muslins, silk manufactures, woollen goods and shawls, embroidery, carpets (wool and cotton), and miniature painting.

WESTERN INDIA (Bombay Presidency, Berār, and Baluchistān). *Commercial.* Gums, oilseeds, cotton, wool, hides and skins, drugs, wheat, salt. *Artistic and Minor.* Gold and silver plate, wood-carving, marquetry, horn, leather and skin work, cotton goods, silk manufactures, embroidery.

SOUTHERN INDIA (Madras Presidency, Hyderābād, Mysore, and Coorg). *Commercial.* Oilseeds, *ghī* and tallow, indigo, cotton, coir, ivory, skins, tea, coffee, cigars, cardamoms and pepper, sugar, spirits, rice, sandal-wood, pearls, gold, manganese, plumbago, cement. *Artistic and Minor.* Gold and silver plate, encrusted ware, copper and brass ware, stone-carving, inlaid wood, sandalwood carving, ivory-carving and staining, dyeing and hand-painting, silk manufactures, embroidery, carpets and mats (cotton and wool).

BURMA. *Commercial.* India-rubber, varnish and lacquer, cutch, cigars, rice, teak-wood, petroleum (kerosene and candles), tin, rubies. *Artistic and Minor.* Wrought iron, niello-ware, gold and silver plate, copper and brass moulding and ware, wood- and ivory-carving, lacquer ware, and glass mosaic.

The large number of commercial products and the poverty of artistic manufactures in Bengal, the small number of important and characteristic materials and crafts in Western India, and the comparative abundance of these in Southern India are significant features. In Burma, the artistic crafts are more numerous, and in some respects more important, than the commercial products. In Northern India, too, where external commerce is of less consequence than in the maritime Provinces, there may be said to be almost a superabundance of artistic industries.

In the Indian Museum at Calcutta, economic products, with the manufactures derived from them, have been arranged under the following classes:— Classification of industries according to materials.

I. Gums, Resins, Oleo-resins, Inspissated Saps, &c.
II. Oilseeds, Oils, Fats, Perfumery, &c.
III. Dyes and Tans.
IV. Animal (Industrial) Products.
V. Fibres and Fibrous Materials.
VI. Drugs, Medicines, Chemicals.
VII. Edible substances, including Narcotics.
VIII. Timbers.
IX. Metals and Minerals.

Positions can readily be found for every indigenous craft and exotic industry of India under this classification, which will accordingly be adopted for the purposes of the present chapter. Each of the following sections will deal with one of these classes, and with the arts and industries derived therefrom.

II. Industries derived from Gums, Resins, Oleo-resins, Inspissated Saps, &c.

The articles thrown into this class might almost be spoken of as derived from the vegetable kingdom, though a few, including some of great importance, such as lac and wax, are animal products.

Little or no statistical information can be furnished regarding the internal trade in these articles, many of which are extensively used in village industries all over the country, but the foreign transactions shown in Table I (p. 253) may be regarded as affording some conception of their importance. Trade.

With the exception of camphor, none of the imported goods shown in the table can be regarded as being raw material used in Indian manufactures. There is a fairly large industry in refining camphor, and in the assortment of the imported gums. Fully one-third of these imports are again exported. It is probable, however, that the transit trade in gums, drugs, &c., will decline, and that the ports in the Persian Gulf and Red Sea from which it is derived will in the future consign more of their supplies direct to Europe, instead of *via* Bombay.

The names cutch, catechu, and gambier include four commercial substances. The resinous extract prepared by boiling chips of the wood of *Acacia Catechu* is the pale catechu or *kath* of the sub-Himālayan tract: from the wood-chips of *A. catechuoides* is derived the Pegu cutch: the boiling of Cutch and gambier.

the ripe betel-nuts of the palm *Areca Catechu* produces the areca catechu of Madras and Mysore: and gambier is made by boiling chips of the climbing stems of *Uncaria Gambier* found in the Malay Archipelago, Java, and Sumatra. Chemically these four substances are very similar, containing as their active principles catechu-tannin and catechin. The finer qualities, such as the imported gambier and the pale catechu, possess a higher percentage of the latter. They are regularly chewed along with betel-leaf in the preparation known as *pān*. The darker coloured and coarser qualities, such as the cutch of Pegu, are largely employed as dyes and tans, especially for fishing-lines and nets.

The production of cutch from Burma averages from 130,000 to 150,000 cwt. a year, and that from Southern India and Bombay about 1,500 cwt., while Bengal and the United Provinces contribute about 20,000 cwt.

Lac and lac turnery.

The restriction of the words lac and lacquer to denote two closely allied yet in many respects widely dissimilar industries is convenient, even if it be not quite justifiable etymologically. The material used in the former is the resinous extract derived from a hemipterous insect (*Tachardia lacca*), and the latter is a natural vegetable varnish. The lac industry is confined to India; but there are two great centres of lacquering, Japan and Burma.

Lac yields two products—a rich deep-red dye and a resin perhaps best known in sealing-wax. The quest for a satisfactory supply of cochineal gave to England her first direct knowledge of lac. Hence our language derived the colour 'lake' from the Sanskrit *lāksha*, as it had 'crimson' from the Greek *kermes*, 'vermilion' from the Latin *vermiculus*, and 'cochineal' from *cochinella*, a grain or berry. In the *Ain-i-Akbarī* reference is made to the use of lac as a varnish for woodwork. Van Linschoten, the Dutch *savant* whose travels were published in 1596, gives the first detailed description of both the dye and the resin; and in the 'First Letter Book of the East India Company' there are numerous references to 'gumlac,' 'gumlacre,' and 'laqua.' So important, however, did the dye become, that at first it completely dwarfed the knowledge of the resin.

Production.

The lac insect lives on plant juice sucked up by means of a proboscis. The larvae escape from the dead bodies of the females, and crawl away in search of fresh twigs. Those that survive penetrate the twigs and become permanently fixed there till they emerge as insects, and the resinous exudation

is formed around their bodies. The twigs continue to be encrusted until the crop is collected in May–June and October–November, or just before the swarming seasons. The forest trees on which lac is reared are very numerous and diversified, but the best known are *Butea frondosa* (*dhāk* or *palās*), *Schleichera trijuga* (*kusum*), and *Shorea robusta* (*sāl*). In Sind much success has been attained by propagation on *Acacia arabica* (*babūl* or *kīkar*), and in Assam a special crop of *Cajanus indicus* (*arhar*) is grown upon which to feed the insect. It has long been believed that the well-known differences in the quality of lac were due to the nature of the plants on which the insect is reared, but a more careful study seems likely to lead to the discovery of several species that would give the pale or colourless lac so much appreciated.

Twigs encrusted with lac are collected and sold to the dealers under the name of 'stick-lac.' These are dried, broken up, and crushed, the wood removed, and the lac pounded and washed under water. The washings, when boiled down and concentrated, become 'lac-dye,' and the washed lac is known as 'seed-lac.' According to the purpose for which it is required, the latter is mixed in certain proportions with yellow arsenic or with resin. It may be here observed that the considerable imports of foreign resin (mostly Canadian) received by India are mainly, if not entirely, intended to meet the demand of the lac manufacturers. The pure or mixed lac is now placed in long shallow bags, made of American drill, and these by a simple contrivance are twisted in front of fires till the lac melts and is squeezed through the texture of the bags. When sufficiently cooked, it is spread out on hot tubes until it assumes the form of large thin sheets. These are next taken up by skilled operators who stand in front of the fires, and stretch the sheets till they become as thin as paper, forming the 'shellac' of commerce. Instead of being made into sheets, the molten lac may be dropped on to smooth surfaces, the result being 'button lac.' A definite percentage of resin is an indispensable feature of most lacs, as it lowers the melting-point; but beyond that proportion it becomes adulteration. The arsenic is required to impart a certain opacity and colour demanded by the trade. 'Garnet lac' is a quality very largely produced at the steam-power factories. As its name implies, it is of a rich deep-red colour; no arsenic is employed in its preparation, and it is in demand for industries where colour is no disadvantage.

Manufacture.

Although steam-power has been successfully applied to

this industry, the hand-labour factories still hold their own and for some grades produce qualities hardly if at all attainable by machinery. Lac factories are almost confined to Bengal and the United Provinces. During the five years ending 1903 the average number of factories registered was 102, giving employment to nearly 7,000 persons.

Industrial uses.

Lac is employed for many purposes, the most important of all being its use as a spirit varnish, while it is also the chief material of sealing-wax. Large quantities are used as a stiffening material in hat-making, as an ingredient in lithographic ink, and as a cement. In India it enters into the agricultural, commercial, artistic, manufacturing, and domestic doings of the people to an extent hardly appreciated by the ordinary observer. The existence of the poorer communities in agricultural and forest tracts is made more tolerable through the income derived from the collection of the crude article. Village carpenters, cartwrights, and turners all use lac in some form or other to varnish or colour their goods. Silver- and copper-smiths employ a lac bed upon which to hammer and punch their wares, while coloured ornamentations are made on brass in imitation of enamelling and inlaying. Workers in ivory colour many of their goods with lac, the patterns being scratched below the surface. Lapidaries construct grindstones of the same material, and employ it to cement the blade to the haft in knives and swords. Potters, bookbinders, and makers of smoking-pipes all need lac as a varnish or stiffening material. Jewellers load hollow gold and silver ornaments with it, or fix stones by its means. The makers of the humbler personal ornaments prepare many varieties of lac, and by its use colour pieces of tin-foil (tinsel) placed under glass to imitate precious stones. It is possible that one of the very earliest utilizations of lac was in fact this preparation of peasant jewellery. Lastly, in the hands of the lac-turner or toy-maker lac is of supreme importance.

Artistic work.

Lac turnery may be viewed as a special feature of Indian art, for practically every town of note has its lac-turners. Wooden objects are coated with coloured lac while revolving on the lathe, and by different methods of treatment most varied and artistic effects are produced. The chief centres of plain lac ornamentation are Patna, Murshidābād, and Bīrbhūm in Bengal; Sylhet in Assam; Sahāranpur, Agra, Lucknow, Fatehpur, Benares, and Mirzāpur (which produce the Benares toys of trade) in the United Provinces; Shāhpur, Ferozepore, and Hoshiārpur in the Punjab; Alwar, Jodhpur, and Bīkaner

in Rājputāna; Sāvantvādi and Bombay city in Bombay; Salem, Nandyāl, and Podanūr in Madras; and Bangalore and Channapatna in Mysore. Etched lac-work with floral designs is also prepared throughout India, the most noteworthy centres of production being Bannu and Dera Ismail Khān in the Frontier Province; Pākpattan (Montgomery District), Ferozepore, and Hoshiārpur in the Punjab; and Jaipur and Indragarh in Rājputāna. Painted lac-ware, showing bunches of flowers, groups of animals or hunting scenes, attains its highest perfection at Hyderābād (Sind), but this beautiful art is now steadily disappearing.

Trade.

The first recorded exports of lac to Europe took place about 1790; but the trade progressed very slowly, and in 1868–9 the shellac sent to Europe had reached a valuation of less than 12 lakhs and the lac-dye of 8 lakhs. Since then the trade in lac-dye has gradually disappeared, while the exports of shellac have increased to more than 2 crores in 1903–4. The trade in the latter commodity is, however, subject to remarkable fluctuations in both amount and price.

Burmese lacquer.

The chief material used in Burmese lacquer-work is the oleo-resin (*thitsī*) obtained from *Melanorrhoea usitata*. This is either employed in its liquid state as a varnish, or is thickened by ashes or sawdust to a plastic condition and used as a moulding material or as a cement for mosaics. It is coloured with lampblack, with gold or silver leaf, with vermilion, with orpiment, with indigo, &c., and is applied with a brush or by the hand direct or while revolving on the turning lathe. It is used as an ordinary varnish on woodwork or utilized to render paper or cloth waterproof, as, for example, in the manufacture of the very characteristic and artistic umbrellas of Burma. It is also employed as a putty to fill up defects in woodwork, or to close the meshes of basket-ware so as to convert articles into watertight drinking cups and boxes. The best examples of Burmese lacquer-ware are the Pagan basket-ware, the gold-lacquered boxes and baskets of Prome, and the boxes, thrones, &c., with moulded lacquer ornamentations, produced at Mandalay. In Manipur lacquer-work very similar to that of Burma is produced; but it is here applied mainly to the ornamentation of sword scabbards and handles, leather belts and the like.

Burmese glass mosaic work.

The method of imbedding coloured glass on the soft *thitsī* may be presumed to have led to the Burmese art of glass mosaic so extensively followed in the ornamentation of pagodas. In this instance thickened *thitsī* is employed as a cement, and by this art the surfaces of walls, pillars, and

ceilings are often richly covered with elaborate designs in coloured mirror glass.

Trade. No particulars can be furnished regarding the magnitude of the Burmese lacquer trade. *Thitsī* is not in demand in Europe or India, although the material lends itself to many arts and industries. There are no exports, therefore, of the crude article; but since no Burmese household exists without a numerous and varied assortment of lacquered boxes, platters, cups, &c., the industry is important locally. There is also a small export of Burma lacquer-work, mainly to the Straits Settlements. On the other hand, the imports of Chinese and Japanese lacquer wares into India in 1903–4 were valued at about 1¾ lakhs.

Varnish and varnished wares. Special varnishes are prepared all over India by dissolving resins in boiling oil. Several firms in Calcutta and Bombay regularly manufacture and sell such varnishes; but, as a rule, the Indian craftsmen prepare their own varnish and very often

Gesso. prefer foreign copal to any Indian resin. Varnish, besides being required for woodwork generally, is in demand for special artistic crafts which may be regarded collectively as forms of gesso. In Bīkaner this art is used in the decoration of doors and the interior walls of houses, and has recently been applied to skin oil-flasks (*kuppīs*); in Shāhpura (Tonk) it is employed in the ornamentation of shields, which have been thought (without sufficient evidence) to show Japanese influence; in Hyderābād (Deccan), in the production of fans, trays, &c.; and in Nosam and Nandyāl in the Kurnool District of Madras, in the elaboration of tables, door-panels, and plates. The most striking difference between the gesso work of Nosam and of Hyderābād is the greater abundance of interposed animals in the former.

Wax and its uses. Bee-culture is not an important industry in India, though it might easily and most advantageously be made so. In consequence, the collection of honey and wax is usually one of the minor forest occupations, farmed out to jungle or hill tribes. Wax is produced on a fairly large scale in certain Districts of Southern India and of the Central Provinces, and to a smaller extent in Bombay and Bengal. From the Western Himālayas, again, the export of wax is considerable, and wild honey and wax are collected in Burma.

Beeswax is exported from India in fairly large quantities, but the traffic does not expand. In 1876–7 the exports were valued at 7·3 lakhs; in 1886–7 at 3·6 lakhs; in 1896–7 at 2·8 lakhs; and in 1903–4 at 4·4 lakhs. Wax is used locally

in many industries, but not to the extent that might have been anticipated. It is, for example, employed as a resistant material in certain processes of dyeing; it is used in moulding and in metallic castings, especially in Burma; but at the present day it is rarely made into candles.

The most artistic use of wax in India is its special application to the dyers' art. There are three characteristic centres of this craft. In Kālahasti, in the North Arcot District of Madras, mythological subjects delineating scenes from the Rāmāyana and the Mahābhārata are produced on cotton cloth; in Masulipatam and elsewhere in Southern India, admirable chintzes have for many centuries been turned out, which are really hand-painted textiles, so perfectly coloured that it is sometimes difficult to distinguish them from the finest embroidery; in Burma, silk fabrics are printed with wax before being dyed. In all these instances beeswax is used to protect portions of the fabric from receiving the dye which is applied to the exposed surfaces, and by repeated alternations of waxing and dyeing the most varied and effective results are obtained. No particulars are, however, forthcoming as to the extent of the traffic in these fabrics. The art may be characterized as one of the most distinctive features of the textile industries of Southern India, whose chintzes are much more nearly related to those of the Malay Peninsula than to the calicoes of the rest of India. It is much to be regretted therefore that this beautiful craft has for some years given tokens of decay, owing to the demand for cheaper printed goods.

Employment of wax in dyeing.

III. Industries derived from Oilseeds, Oils, Fats, and Perfumery

The materials and industries which fall under this section are mainly of agricultural interest. Some conception of their total value to India may be gathered from a study of the imports and exports. In 1900-1 these were collectively valued at 11 crores and in 1903-4 at 17 crores. Oils may be primarily classed as fixed and as volatile (essential), and each of these may be subdivided into animal, vegetable, and mineral.

If the figures shown in the returns of the foreign trade of India are rearranged, so as to bring together all the items that belong to the animal and vegetable oils and fats, but to exclude as far as possible the mineral oils, the results shown in Table II (p. 253) are obtained.

Trade in animal and vegetable oils and fats.

Both the imports and exports have greatly expanded during the past twenty-seven years, more especially the former. The export trade in vegetable oilseeds is still by far the most important single item.

Industrial uses.

Dyers and leather-workers all use oil, and have done so from the remotest antiquity. One of the most important Indian uses of this article is the anointment of the person with sweet oils. The use of soap as a personal detergent is to the mass of the people an unknown luxury. Crude soap is, however, largely manufactured and sold to washermen and dyers, and latterly soap manufacture on European methods has been successfully introduced. Candles also are extensively used by the natives of India. Crude 'tallow dips' are produced here and there all over the country, but the bulk of the candles used are imported from Europe. Within the last few years, however, a formidable rival to this import traffic has arisen through the manufacture of candles in Burma from wax procured in the refinement of petroleum, and through the production of similar candles at Calcutta from imported wax and paraffin. In the official trade statistics the imports of candles are returned collectively, so that it is not possible to separate those made of mineral wax from those made of animal or vegetable waxes.

Oilseeds and oils.

There is a large export of oilseeds from India, the principal heads being linseed, sesamum or gingelly, rape, cotton-seed, castor-seed, ground-nuts, coco-nuts, and poppy seed—*vide* chapter i (Agriculture). The export of these seeds instead of the expressed oil is injurious from an agricultural point of view, as it deprives the soil of useful manurial constituents. It is satisfactory, therefore, to note that the local production of oil from these seeds is making progress. In 1903 the number of the more important oil mills was ninety-nine, giving employment to about 4,600 persons. The suburbs of Calcutta are crowded with private castor-oil mills.

Illuminating oil.

The growing popularity of kerosene and other mineral oils must have curtailed the cultivation and manufacture of many of the minor oils, more especially those formerly grown for illumination and lubrication. Thirty years ago European residents in India, and the wealthier natives, employed either castor or coco-nut oil for house illumination. The introduction of refined kerosene from America drove these completely out of use within a remarkably short time. The import of a less pure but cheaper Russian oil, with which Burma oil is now competing, and the supply of cheap German lamps suitable

for the consumption of kerosene, have caused a still greater displacement of vegetable illuminating oils. Kerosene has, in fact, effected a revolution in the domestic economy of the people of India.

Wax-cloth, oil-cloth, and linoleum.

In the production of the fabrics that bear the name of 'wax-cloth' the natives of India show a knowledge of the drying property of oil. The oil of *Carthamus* (safflower) is boiled for many hours, and then suddenly thrown into cold water, thereby producing a substance called *roghan*. This, when mixed with mineral pigments, forms a thick resinous and sticky paint, which sets and renders the fabrics coated with it waterproof. For this reason, *roghan* is largely used to preserve leather water-buckets. The coloured *roghan* used in the production of wax-cloth is smeared in a somewhat artistic fashion on cloth, and dries and sets rapidly. Wax-cloths are prepared by Afrīdīs in Peshāwar and other towns in Northern India. The craft is met with in other parts, and the oil employed is often derived from linseed or even castor; but the industry is invariably practised by Muhammadan descendants of original Pathān settlers in the plains. This small and unimportant industry is the only example in India akin to the wax-cloth and linoleum industries of Europe, although the Bengal jute mills specially prepare the cloth required in these. India imports a considerable amount of wax-cloth and linoleum. In 1876–7 the imports were valued at only Rs. 18,000, but by 1903–4 they had risen to 4·2 lakhs. There would thus seem ample room for the establishment in India of oil-cloth, linoleum, and waterproof sheeting factories.

Ghī, lard, margarine, and tallow

The traffic in animal oils, fats, butter, *ghī*, lard, and tallow, &c., is extensive and continuously expanding. In 1876–7 the exports under these heads were valued at $7\frac{3}{4}$ lakhs and in 1903–4 at $25\frac{1}{2}$ lakhs. There is also a large import trade, which amounted to $4\frac{1}{3}$ lakhs in 1876–7 and to 14 lakhs in 1903–4. The most important single item under exports is *ghī* (clarified butter), and under imports, animal oils and tallow.

Essential oils and perfumery.

Essential oils, perfumery, &c., vary as to chemical nature and industrial purpose. The classification is convenient rather than logical, as separation between perfumes, cosmetics, and condiments is often extremely difficult. The imports of these articles ($6\frac{1}{2}$ lakhs in 1903–4) are of far less consequence than the exports (20·7 lakhs). The exports of seeds containing essential oils have been steadily increasing for some years: in 1876–7 they amounted to Rs. 29,000 and in 1903–4 to 12·3 lakhs.

Perfumery, one of the most ancient and honourable of Indian crafts, attains its greatest importance in Northern India. Jaunpur, Kanauj, and Ghāzipur may be described as the chief manufacturing localities; Delhi, Amritsar, and Lahore as the distributing centres; and Bombay as the emporium of foreign transactions. The following are some of the more important ingredients in Indian perfumery:—lemon and geranium grass oils, spikenard, rose leaves, *kut*, musk, *galangal*, Himālayan *dhūp*, *patchouli*, *ylang-ylang*, and *keorā*. The use of sandalwood oil as the basis of many products is repellent to some European tastes.

Painting in oils and water-colours.

Indian painting may be broadly divided into three distinct styles—the Buddhist, exemplified by the wall-frescoes in the caves of Ajanta; the Muhammadan style, as shown by the book illustrations and portraits of the Mughal artists, which their successors carry on to this day; and the modern style of oil and water-colour painting as practised in the Schools of Art. The first mentioned is decorative rather than pictorial; and the earliest true pictures of which we have any record are the productions, under Persian influence, of the old Mughal artists, who apparently worked under considerable difficulty owing to the well-known Muhammadan objection to the delineation of natural forms. Probably the earliest encouragement they received was from the broad-minded Akbar. The works of the present day differ little in style from those of the past; and to the casual observer the want of atmosphere, the total disregard of all rules of perspective, and the general stiffness of the composition condemn them absolutely. Closer study, however, brings to light the artist's capabilities for portraiture, combined with a sense of colour-harmony and a grasp of decorative effect. The process of painting by which these works are executed is known as 'body-colour,' that is water-colour mixed with white, which gives them a solidity or 'body'; and the paper used is an ordinary and often thin country-made material. From this style of picture-painting grew the art of miniature-painting, which is carried to a considerable degree of excellence at Delhi. These miniature-paintings are usually executed on ivory by means of the 'body-colour' mentioned above, and generally depict historical scenes, buildings, and portraits. The colours now used are nearly all obtained from Europe, except the gold and white, which are made locally.

The art described above is indigenous to India, but an exotic form has of late years become prominent. This is the

oil and water-colour painting now produced in no small quantity by the students and teachers of the Schools of Art. Some of the work of this class displayed at the Delhi Exhibition of 1903 was remarkably good; but in most of it the drawing was defective and the technique and colouring were crude.

IV. Industries connected with Dyes and Tans

The joint treatment of dyes with tans is in many respects both natural and scientific. Several tanning materials also colour skins and leather, and many tinctorial reagents are used by both dyers and tanners. But a difficulty arises from the circumstance that hair and wool are animal products that cannot theoretically be separated from horn, feathers, and other such substances. It follows that skins and leather, as also ivory, tortoise-shell, and the like, have either to be placed under fibrous materials, or else must be grouped by themselves, as a transitional series between the products employed in their elaboration (gums, varnishes, oils, tans, and dyes) and the textiles proper. It is proposed to adopt the latter course, and the discussion of leather and leather manufactures will accordingly be reserved for the succeeding section. It may further be observed that two of the dyeing and tanning materials, cutch and gambier, have already been dealt with in section ii. Scope of this section.

While the record of most departments of Indian commerce and industry is one of continuous prosperity, the history of dyeing is one of decline. The influence of the modern mineral dyes (more especially aniline and alizarine) has been more destructive to the tinctorial and textile industries of India than is commonly supposed. These cheap colours have injured the artistic feelings of the people and demoralized many of the indigenous crafts. The delicacy and harmony of colour which formerly characterized Indian fabrics have given place to brilliant, if not gaudy and discordant, tints, while the reputation of these fabrics for durability of colour has at the same time been undermined. On the other hand, it has been maintained that the advances of modern tinctorial science have, in their ultimate issues, been in reality more constructive than destructive. This much at all events has to be accepted as a fact, that considerably more than half the colour results attained at the present day in India are due to aniline or alizarine. On the whole, the materials used by the dyers are Decline of the Indian dyeing industry.

not so much at fault as the change in the taste of the people, who have grown tired of pale, delicate colours, and have turned to the opposite extreme for something new. But when this craving for glaring colours has passed away, the Indian dyers are no more likely to revert to the old rejected vegetable dyes than the dyers of Europe have found it necessary to call for the production of the woad of their forefathers. The majority of the Indian vegetable dyes are fleeting, especially the yellows and greens, and all are relatively expensive and troublesome. One of the most pressing modern dangers lies in the fact that there are good and bad qualities of aniline and alizarine, and that their cheapness promotes the use of the inferior kinds. A still greater danger exists in the dyed textiles that are yearly pouring into India from foreign countries. These have given the Indian craftsmen models in vulgarity that may take a century or more to efface.

Trade. An inspection of the official returns of foreign trade in dyes and tans, abstracted in Table III (p. 254), reveals some striking facts. The total imports were, in 1903–4, valued at 98 lakhs, or more than seven times as much as those of 1876–7, while the exports were valued at 176 lakhs or about one-half of those of 1876–7. This very serious loss to Indian commerce and agriculture may be said to represent the complete destruction of the safflower, the *āl*, and the lac-dye industries, and the serious decline that has taken place in that of indigo. The falling off in the exports of indigo has been continuous and rapid. The transactions of 1902–3 were, for example, 27 per cent. less in quantity, and 35 per cent. less in value, than those of the preceding year, while in the five years ending with 1902-3 the acreage devoted to indigo had been curtailed by about one half. In vivid contrast with these losses, it may be stated that in 1903–4 the imports of aniline and cheap alizarine dyes were valued at 82·7 lakhs, while in 1876–7 they had been only about one-sixteenth of this figure. It may be added that the imports into India of coloured, printed, and dyed cotton goods constitute a large and prosperous trade. In 1876–7 these imports were valued at 2·8 crores, and in 1903–4 at 8 crores; and they may thus be regarded as successfully contesting the markets held for many centuries by the village *rangrez* or dyer and the *chhīpīgar* or calico-printer.

Indigo. Indigo has been fully dealt with in chapter i (Agriculture), and it will suffice to say here that, in addition to the now declining production of the dye itself, there was formerly

a large export of indigo-dyed goods from India. The only survival of this is the export of blue cloth from Pondicherry to French Indo-China, a survival due apparently to France's protectionist enactments in favour of her colonies.

The safflower or *kusum* (*Carthamus tinctorius*) is largely cultivated in India. It affords an oil-yielding seed as well as a dye, and not long ago the dye was an important article of export from Bengal. Thus its exports stood at 13,000 cwt., valued at $7\frac{1}{2}$ lakhs, in 1873-4, but had declined to 4,300 cwt., valued at Rs. 67,500, in 1903-4. While, so far as the external trade is concerned, safflower has sunk to absolute insignificance, it still holds an honoured position among the dyes used by the people of India. It affords a rich delicate shade of rose-pink, is cheap, easy of application, and fades readily—all qualifications that commend the aniline dyes for the temporary purposes so much in vogue with the people in India: hence safflower has been able to hold its own more effectually than has been the case with many other dye-stuffs. The value of the oilseed obtained has, no doubt, helped to preserve this crop in the unequal contest with mineral dyes. Safflower.

The traffic in turmeric or *haldī* (*Curcuma longa*) has been less affected by modern chemical discoveries than that in other Indian dye-stuffs. This is doubtless due very largely to the circumstance that turmeric is perhaps more valuable as a condiment than as a dye. The exports have fluctuated considerably, but were practically as high in 1902-3 as they were thirty years ago. In 1903-4, however, there was a large decrease, the exports of that year being 68,000 cwt., valued at $4\frac{1}{2}$ lakhs, against 126,000 cwt., valued at 10 lakhs, in 1902-3. There are two varieties of turmeric, one giving a hard rhizome rich in dye, and the other a soft aromatic edible root-stock. Turmeric.

The consumption of turmeric as an article of food in India must be very great. No returns are available as to the area devoted to the crop, but it is possible that it is at least 100,000 acres. Madras shows much the largest production, followed by Bengal and next by Bombay, while the United Provinces head the list of the importing Provinces.

The *āl* plant (*Morinda tinctoria*) was formerly extensively cultivated in Rājputāna, Central India, Berār and the Central Provinces, and in the United Provinces. It was first scientifically described in 1794 from specimens seen under cultivation in Mālwā. At the present day its cultivation is practically confined to one or two localities in the Central Provinces, and there are probably not twenty acres under the *Al.*

crop. An allied species (*M. angustifolia*) is still cultivated in Eastern Bengal, Assam, and Burma, but to a very small extent. *Al* cultivation was exceedingly profitable, and the loss of the industry caused much suffering for many years. The dye gave the rich deep Indian red so characteristic of the dyed textiles of the great central table-land of India, but it has been completely driven from the market by special preparations of alizarine.

Lac-dye.

In 1869–70 the exports of lac-dye (*Tachardia lacca*) to foreign countries stood at about 21,000 cwt., valued at 9¼ lakhs, but from that year they steadily declined, and there has been practically no export since 1896. Not many years ago lac-dye might have been said to represent the profit of the lac factory; at the present day the manufacturer's greatest difficulty is to discover a convenient way of getting rid of this now useless by-product.

Myrabolams.

The fruits of *Terminalia Chebula*, *T. belerica*, and *Phyllanthus Emblica* are collectively designated myrabolams. The most important of the three is the chebulic or black myrabolam. There are various grades of this fruit known in commerce, depending upon the age at which it is collected, and the method of drying adopted. The long oval-pointed and greenish-yellow quality (an unripe fruit) is the best, and is often known as the Jubbulpore myrabolam. The fully ripe, round, soft, and spongy fruit is next to useless. The bulk of the exports are from the forests of the Central Provinces and Bombay.

The traffic in these fruits seems to be in a flourishing condition, giving employment to a large number of forest tribes to whom the trade is of importance. In 1876–7 the exports to foreign countries were 361,000 cwt., valued at 13½ lakhs of rupees, while in 1903–4 they had risen to 1,230,000 cwt., valued at 42 lakhs. Next to indigo, the trade in myrabolams is now the most important single item among the transactions in dyes and tans.

Dyeing and calico-printing; dye-works.

Of the crafts of India none are so universally and frequently employed as those of the *rangrez* or dyer, and the *chhīpīgar* or calico-printer. Cotton is the common dress of the people, and, outside Bengal, brilliant colours are popular. Almost every race and caste has its favourite costume, colour, or method of attire, while festive seasons and ceremonials are marked by the use of distinctive colours in dress. And since the poor possess a limited number of garments, the desire for tinctorial changes can only be satisfied by the repeated

bleaching and dyeing of the same fabric. To this circumstance may possibly be attributed the fact that the majority of the Indian dyes are fugitive, no effort having been made to discover the mordants by which they might be fixed. To the desire for many changes in colour is doubtless also due the modern popularity of aniline and alizarine dyes. They are cheap, easy of application, fade readily, and can be applied time after time without injury to the cloth.

A comparison of the rule of thumb methods that pervade the dyeing crafts of India with the exact systems pursued in Europe leaves no room for doubt that in every direction the native dyer is far behind his Western rival. The ignorance that exists in India regarding mordants would alone place the Eastern craftsman at a disadvantage which no hereditary skill, however admirable, could redeem. It is no matter for surprise, therefore, that departures from the ancient methods and conditions of the dyer's art have been found unavoidable in response to modern demands.

The growth of cotton and other steam-power weaving has accordingly, within recent years, given birth to large dye-works on European methods. Most cotton, wool, and silk factories have dye-works of their own (usually in charge of skilled operatives and scientific experts), and separate dye-works have been started in large towns to dye the yarn and piece-goods of the minor manufactures of the hand-loom workers. These are usually, however, of a small and primitive character. There are as yet no factories for the preparation of mineral or other special dye-stuffs, except indigo.

The indigenous tinctorial industries may be classified as follows:—(*a*) Dyeing and Calico-printing: (*b*) Tie-dyeing: (*c*) Painting and Waxing: (*d*) Tinsel-printing.

Plain dyeing.

The use of wax as a resistant in certain dyeing processes has already been discussed in section ii; the present remarks will therefore be confined to an effort to convey as briefly as possible some conception of the remaining branches of plain dyeing. This industry is practised all over India. Few features of Indian life are in fact so striking as the sudden transition observable in the dresses of the people from the sombre tints of Bengal to the brilliant colours of Northern and Western India. Every Province, indeed very nearly every large town or centre of enterprise, has something peculiar and characteristic in its dyes or methods of dyeing, or in the designs employed by its calico-printers. In the Punjab, as in Kashmīr, the most striking feature is the skill attained in

dyeing the floss silk used in *phūlkāri* embroidery into deep rich shades of old gold, magenta, and purple. The Central Provinces reveal the rich dark red of the *āl* dye. Rājputāna and Central India show the charming art of dyeing the thinnest muslin or net with a different colour on each surface. This art is practised in Alwar and Kotah, and to some extent at Yeola and Nāsik. In Madras the *chay* root took the place of the *āl* dye, and gave the splendid rich deep reds once so famous in the silk handkerchiefs of that Presidency.

Calico-printing with wooden blocks.

So very different are the styles of calico-printing met with in India, that a promiscuous assortment may be arranged with almost unerring certainty under the names of the towns where they were produced. In Bengal this art is practised in one town only, Hājipur near Patna. In the United Provinces, Lucknow, Kanauj, Farrukhābād, Jahāngirābād (Bulandshahr District) and Jāfarganj (near Fatehpur) have each well-marked styles of their own; but collectively their most characteristic feature is the production of minute and elaborate designs on a white or pale-coloured field: these correspond very closely with the prints of Europe. In the Punjab, Kamālia, Sultānpur, Lahore, Amritsar, and Gurdāspur are famous, and the Punjab series is collectively as distinct from that of the United Provinces as it is possible to imagine. So also, though of a still higher artistic order, is the series representative of Rājputāna and Central India, which embraces the calicoes of Ajmer, Sanganer, Jaipur, Jodhpur, Udaipur, Kotah, and Ujjain. Almost classical in design and in vivid floral conventionalism, these products are superior in technique to the calicoes of the rest of India. They are generally produced on fine white cotton with the patterns printed through. Western India has several noted centres, such as Ahmadābād, Baroda, Broach, Kaira, and Surat in Gujarāt; Bombay city; and Khāndesh, Dhārwār, and Nāsik in the Marāthā country. Here fuller's earth, castor-oil, beeswax, and gum are often used as resistants. After being printed with a preparation of one or more of these substances, the fabric is dyed for the ground colour, very often by means of a brush, and in separate bands or panels. In Sind, as in the Punjab, preference is given to faded or dull shades, mostly in lemon-yellow, green, brick-red, or orange. But nothing could be more distinctive than the calicoes and chintzes produced in the Madras Presidency. The designs there used are more highly coloured, and more boldly conceived than in any other part of India.

Tie-dyeing.

The once famous Bandana handkerchiefs are perhaps the

best-known example of the art of tie-dyeing. The process is simple in theory, but so laborious in practice that it could only have been invented or pursued in a country where human labour was valued at an abnormally low figure. Portions of a fabric are tied up by thread and soaked in some resistant material in elaboration of the design. It is then dyed, its lightest colour and the threads are unwound, or further points are tied up, and the fabric once more dyed. This is repeated until the design has been completed, when the threads are all unwound and points of various shades are revealed, usually on a dark-brown or black ground. This art is practised throughout Rājputāna, Central India, and Gujarāt. It is occasionally seen in Berār and Madras, and in the Meerut and Muttra Districts of the United Provinces.

Mashrū is a name given to a textile (usually of mixed cotton and silk, but sometimes purely of either material) in which bundles of the warp are transversely tied at fixed intervals before being dyed. The term *mashrū* means 'permitted,' and has reference to the prohibition of the use of fine silk by Muhammadans, save in the form of narrow borders, or in war. When the textile is woven a wavy pattern is produced, known as *khanjarī*. *Mashrūs* are woven all over the United Provinces (more especially at Benares, Azamgarh, and Jālaun), here and there in the Punjab, and occasionally also in Bombay. *Patola* is the name given to a process of tie-dyeing applied to silk, in which bundles of the warp and weft are multi-coloured, and are so arranged that each colour appears on being woven at the exact place where required in the elaboration of the pattern. The beautiful wedding *sāris* of the people of Gujarāt are made of *patola* silk. *Mashrū.*

In many of the high-class calicoes of Southern India block-printing takes a subordinate place, and brush-colouring, with wax as a resistant, becomes the chief method. The beautiful chintzes or *palampores* thus produced have already been briefly referred to. These products were first generally known to Europeans in connexion with Calicut (hence our word 'calico'), but their most famous centre was Masulipatam. The dominant ideas which have separated this art into two widely different forms are derived from the main uses to which the *palampores* were put—as idol canopies by the Hindus, and as prayer carpets by Muhammadans. In the former style the design is mythological, portraying scenes from the Rāmāyana or the Mahābhārata. The most important centres for the production Painting and waxing of calicoes.

of Hindu canopies are Masulipatam, Kālahasti in North Arcot District, Salem, Madura, and Pālakollu (Kistna District). In other towns *palampores* are made for domestic rather than religious purposes, and these usually show sporting and rural scenes, and are largely block-painted.

In the prayer carpets, curtains, and handkerchiefs of Masulipatam, produced under Muhammadan influence, the pattern is usually the Persian tree of life, with birds resting on its boughs and animals reclining below it, and is set out in a deep red-brown with a profusion of blue.

Throughout a large part of Southern India handkerchiefs were formerly produced on a large scale for export, but this trade has now greatly dwindled. The patterns of these, which showed on both surfaces, were in dark red with designs in blue, the outlines being picked out in white. Coimbatore is still noted for its beautiful hand-painted curtains, sheets, and handkerchiefs, the prevailing colour of which is light red with a small admixture of green and dark red. The designs are floral, with birds and animals intermixed.

Tinsel-printing. In tinsel-printing an adhesive substance is applied to the cloth and subsequently dusted with colouring materials or gold and silver leaf. Special varieties of this art are prepared here and there all over India, but those of Lahore, Jaipur, Sanganer, Ahmadābād, Nāsik, and the Godāvari District of Madras are the best.

V. Industrial Products derived from the Animal Kingdom

The animal products now to be discussed form an intermediate series between the articles employed mainly in elaboration of certain industrial results (gums, oils, dyes, &c.) and those which constitute the actual material of the industries, such as fibres, timbers, and metals. By far the most important product of this class is leather, more details regarding which will be found below. The traffic in hides and skins is in fact one of the staples of Indian export, and during the five years ending with 1903–4 the average value was about £6,000,000. The undressed skins of full-grown bovine animals are usually called 'hides,' while those of calves, sheep, and goats are known as 'skins.' A very considerable number of indigenous and foreign industries specially depend on the supplies of the animal substances falling under this section. The foreign transactions of 1903-4 are shown in Table IV (p. 254). The

exports have increased in a very much higher ratio than the imports, a circumstance that would appear, in some measure at least, to be due to the improvements effected in local manufacture.

It is probable that the local manufactures in skins and leather in India are fully as valuable as the foreign transactions in these commodities. In 1876–7 the value of the imports and exports was about three crores of rupees, and in 1903-4 nearly ten crores. During the famine years 1899–1900 and 1900–1, when the supply of hides was largely increased by the death of cattle, the conditions of the trade (due to some extent to the war in South Africa) created an exceptionally brisk demand. Prices were thus maintained, in spite of the fact that 32,000,000 hides were exported in the two years. Hides, skins, leather, and manufactures.

The curing, and to a smaller extent the tanning, of skins is practically confined to Southern India, and the exports are conveyed mainly to the United States. From Bengal skins are exported in the salted condition. But within the last few years it has been observed that, while the export traffic in dressed goods has slightly decreased, the demand for Bengal raw skins has increased considerably. This is presumed to be in consequence of the cheaper and more efficient methods of tanning now practised in the United States.

In 1893 there were forty-four large tanneries in India which gave employment to 3,804 persons, while in 1903 there were forty-three tanneries with 7,900 employés. Of these tanneries, thirty-seven were in the Madras Presidency, and were concerned very largely in the dressing and tanning of the skins above mentioned. The tanneries of Northern India, especially those at Cawnpore, produce leather, and are, moreover, very largely engaged in the saddlery, boot and shoe, and leather trunk trades. They also supply a proportion of the leather that is used by the village saddlers and shoemakers. All over India skins are roughly tanned by certain classes, and it is no uncommon sight to find the skin of an animal filled with tanning material hanging from the bough of a tree until the desired change has been accomplished. In other instances crude vats containing but one or two skins are to be seen near leather-workers' houses. Tanneries.

India possesses an extensive series of very excellent tanning materials, such as acacia pods and bark, cutch, Indian sumach, tanner's cassia, mangroves, myrabolams, and others. With these and similar materials, and by various methods and contrivances, hides and skins are extensively cured, tanned, and

curried, and the leather is worked up in response to an immense and purely local demand. Attempts are now being made in the Madras Presidency to introduce chrome tanning.

Boot and shoe trade.

The imports of boots and shoes have for some years been increasing rapidly. In 1886–7 the supply was valued at 11·3 lakhs, and in 1903-4 at 27·9 lakhs. Local manufactures are, however, still more important. Every village and town has its shoemakers; in the cities whole streets are occupied by them, and one of the most striking features of the trade in some places is the large number of Chinamen engaged in it. Native shoes are often elaborately embroidered, and even jewelled. The places most famed for artistic shoes and leather work generally are—Cuttack, Patna, and Sāran (Bengal); Rāmpur, Lucknow, Agra, Jhānsi, and Sahāranpur (United Provinces); Rāwalpindi, Dera Ghāzi Khān, and Hoshiārpur (Punjab); Peshāwar and Kohāt (Frontier Province); Chānda (Central Provinces); Jaipur and Bīkaner (Rājputāna); Surat, Ahmadābād, Poona, Ratnāgiri, and Hyderābād (Bombay); and Raichūr, Salem, Trichinopoly, Madras, and Mysore (Southern India). These are the chief centres of the native trade; but, as already said, Cawnpore stands out pre-eminently as the commercial centre of the modern trade in boots of European style, shoes, saddlery, military equipments, trunks, &c. Lastly, it may be added that for the past ten years or so India has begun to export boots and shoes. In 1898–9 this traffic was valued at 3½ lakhs, and in 1903–4 at 6 lakhs. These exports go from Calcutta and Bombay, and are consigned mainly to Natal, Cape Colony, Mauritius, and Egypt.

Artistic manufactures.

The sword-slings and belts of Peshāwar, Bannu, Kohāt, the Derajāt, and Quetta are often beautiful and richly embroidered. The powder-flasks, bullet-cases, and pouches attached to them also frequently exhibit fine work. Artistic water-bottles are made in Madras; and Lahore, Sirsa, and Hissār produce leather bowls for *hukkas*. Pen-cases, cigar-boxes, and dressing-cases are produced in Nepāl, in Hoshiārpur District, and at Bilāspur. The socks (buskins), trousers, and coats made at Kāngra and Hoshiārpur from deer-skin (*sāmbar*) are famous all over the Punjab. Afghān *postīns* (coats of sheep-skin with the wool turned inwards) are richly embroidered. Bannu buskins, in soft red leather, are also well-known.

The Cawnpore saddlery, which is famous all over India, is quite plain; but ornamental saddlery and camel trappings are produced in Jaipur (Kheri), Bīkaner, Kāthiāwār (Kundla), and Indore; and at Sāran in Bengal. The embroidered *sāmbar*

leather sheets of Hyderābād (Sind) have bold and effective designs. Gorakhpur also produces embroidered *sāmbar* work in the form of saddle-cloths and table-covers, and the embroidered leather of Chānda (Central Provinces) is the last relic of the former prosperity of that town.

At Nosam, in the Kurnool District of Madras, leather mats are quaintly painted, and in many parts of Rājputāna and Bombay leather is admirably stamped and engraved in book-binding. The most noted centres of this art are Alwar and Ahmadābād. The carving of rhinoceros hide shields is an old but decaying industry in Gujarāt. In former days these shields were used by Arab mercenaries; they are now made only as ornaments, chiefly for Europeans. The hides are imported from East Africa. In some cases, instead of being carved, the hide is so cured as to become almost transparent and of a pale amber colour.

India is very largely dependent on foreign countries for its supplies of ivory. African ivory is closer in grain, and not so liable to turn yellow, or to warp and split, as the Indian. 'Green' ivory is much better than 'dead': the latter term denotes ivory found on the ground, or stored so long that it has lost all its gelatine and become brittle and non-elastic. All the finer and more expensive ivory-carvings are, as a rule, done on the best African ivory; and even in inlaying, the hair-lines are invariably in the bluish white African article, the larger patches being in the dull chalky Indian quality. It is a curious fact that the armouries of the Indian princes contain a large number of daggers, the hafts of which are made of fossil walrus ivories. Some of these weapons have histories that carry them back for centuries; and the traffic in conveying these special forms of ivory from Siberia, or even from Greenland, to India, mostly by tedious land routes, must have existed long anterior to the present channels of commerce. Ivory.

Five localities are specially noted for their artistic ivories: namely, Delhi, Murshidābād, Mysore, Travancore, and Moulmein. The ivory-carving now produced at Delhi is modern, and mainly Hindu in character; the articles produced are richly designed and carefully finished—caskets, glove-boxes, table ornaments (miniature elephants, camels, horses, carts, &c.), paper-cutters, card-cases, whist-markers, chessmen and the like. The Bengal ivory-workers, like those of Delhi, produce a large variety of little ornaments (models of elephants, bullock carts, processions, &c.) for the European market. The ivory carvings of Mysore and Travancore must, however, receive the Ivory-carving.

foremost position in India, and their decorative designs are drawn from the early Chālukyan and Jain traditions rather than from the Dravidian and Indo-Aryan schools. Burmese ivory-carving seems to have been derived from India. The articles chiefly produced are dagger and *dah* handles, picture-frames, paper-cutters, stands for silver bowls, chessmen, chairs, and images of Buddha.

Ivory-carving is, as a rule, hereditary, but there is no special caste identified with the craft. At some parts of the country the carvers are carpenters, or silversmiths, while in places they are Muhammadans. At Murshidābād the industry, though originated by Muhammadans, is to-day in the hands of Hindus.

Ivory-turning.

Ivory-turning, which is less artistic than ivory-carving, is even more widespread: in fact, most towns have a few workers of this class who make small articles such as bangles, chess-men, antimony boxes, and idols. The best specimens of ivory-turning are produced in Agra, Alwar, Bikaner, Jodhpur (more especially Pāli), Amritsar, Ludhiāna, Patiāla, Tippera, Tirupati, and the Godāvari District of Madras. With the Sikh the use of a comb is almost a religious observance, and in Amritsar and other towns of the Punjab ivory combs of great beauty are to be had. Occasionally large sums are expended on special chairs, howdahs, and thrones veneered with ivory, as also in the purchase of rugs and fans woven out of threads cut from the tusk.

Ivory-inlaying.

In several parts of India wood is inlaid with ivory, but three localities are especially noted for the superiority of their work: namely, Mysore, Hoshiārpur in the Punjab, and Monghyr in Bengal. The Mysore work, where the surface of the ivory is ornamented with black designs, is of special excellence. Bone is sometimes used as an inferior substitute for ivory in inlaying.

Marquetry, ivory boxes, &c.

The term 'Bombay Boxes' has become a trade name for sandalwood boxes veneered with ribbons, which are built up of strips of ivory and coloured woods and tin, glued together lengthwise in elaboration of some design and then cut transversely to form the ribbons. This is a form of marquetry and is called *sadeli.* It is largely practised by the Hindu and Pārsī cabinet-makers of Bombay city, Surat, Baroda, and Ahmadābād. Sometimes, in place of *sadeli*, the boxes have carved sandalwood or carved black-wood panels. In Southern India, and mainly in the town of Vizagapatam, a somewhat similar industry exists, in which the outside of sandalwood

boxes, book-racks, &c., are veneered with thin layers of horn, tortoise-shell, or ivory, the ivory being often coloured with lac or cut by the fret-saw until it is as fine as lace. The ivory is, moreover, frequently overlaid on veneers of tortoise-shell or horn. In the Kotah State boxes and powder-flasks are veneered with horn, ivory, and mother-of-pearl set in lac. Ivory mats, made up of strips of such fine texture that the ivory is literally woven, are curiosities produced at Tippera, Dacca, Bharatpur, and elsewhere.

Miniature painting on ivory.

Miniature painting, which has attained a high proficiency in Northern India, is almost invariably practised on slabs of ivory, so that it becomes one of the arts dependent on ivory.

Horn.

Articles made from buffalo horn are largely produced, but are not, generally speaking, of much artistic value. The chief centres of the trade are Cuttack, Monghyr, Sātkhira (Khulnā District), Hooghly, and Serampore in Bengal, where combs, brooches, necklaces, bangles, and the like are made. Sibsāgar in Assam turns out salad spoons with quaint elephant handles; and the Jaipur bows, ornamented in diaper pattern, deserve notice. The Rājkot combs, Baroda spoons, and Kāthiāwār knife handles, and the Surat and Ahmadābād boxes veneered with horn, are all well-known. In Mysore umbrella handles, powder-boxes, and buttons are made of buffalo horn, and are often richly inlaid with ivory and copper. Madura produces excellent horn-carvings of animals. In Ratnāgiri and Sāvantvādi (Bombay) bison horn is made into highly artistic table ornaments.

Bristles.

Brush-making, while not by any means developed to the full extent possible, still exists in India. Within the past ten years the exports of bristles and other brush-making fibres have greatly expanded, and in 1903–4 were valued at $20\frac{3}{4}$ lakhs.

Feathers.

The export trade in feathers is declining, owing to the prohibition issued in 1902. In 1886–7 the traffic was valued at $5\frac{1}{4}$ lakhs, and in 1903–4 at only Rs. 5,100. Peacock feathers are largely used in India, the chief centres of their artistic utilization being Benares, Nepāl, Jhānsi, Aurangābād, Sāvantvādi (Bombay), and Mysore. They are generally made into fans and fly-flappers. Formerly they were extensively employed in the manufacture of braids and trimmings exported to Europe for the ornamentation of ladies' dresses.

Coral.

The traffic in coral consists mainly of the real article procured from Italy. Bengal receives the largest amount; but the trade is subject to extreme fluctuations, and depends very largely on the demand of the great trading and banking

communities of the Hindus, who chiefly indulge in necklaces of this material.

Shell industries.

Pearl and chank fisheries are important in the extreme south of India and to some extent in Burma also. The supply from these does not completely meet India's demands, and from 3 to 4 lakhs' worth are annually imported from Africa into Bombay and Bengal. The conch shell is cut into bracelets, armlets, charms, table-napkin rings, brooches, and the like. In Eastern Bengal, and more especially in Dacca, the *sānkhari* or shell-carver is by no means an insignificant member of the artistic community. Shell bracelets, &c., after being carved, are coloured by lac melted into the sunk portions of the design. The industry is practically confined to Bengal. Mother-of-pearl is procured at the Indian fisheries, and is used by both stone and wood inlayers, more especially in Northern India.

VI. Fibres, Textiles, and Textile Industries

Classification of materials.

After food-stuffs, no other group of products or industries is of such importance to India as that of textiles. The broadest conception of these includes all vegetable and animal fibres, whether simply plaited into basket-work, twisted into coarse rope, felted into paper, or spun and woven into fabrics of gossamer texture. Of the Indian vegetable fibres, cotton and jute are by far the most valuable. They are followed by coir, aloe, hemp, and paper-making materials, and then by rope, cordage, brush-making, mat-making, and basket-work fibres. Flax (linen) is chiefly of interest as an imported article; and though much has been written about rhea or China grass, it is, so far as India is concerned, a curiosity more than a regular article of trade. There are perhaps 300 fibre-yielding plants in India; and of these about 100 are more or less regularly used by the people, but only ten or twelve are established articles of trade. Of the animal fibres, silk, wool, *pashm*, and hair are very important.

Foreign trade.

Some conception of the magnitude of the textile interests of India may be conveyed by the circumstance that the total foreign transactions in 1903–4 were valued at more than 98 crores (£65,500,000 sterling), being nearly two and a half times as much as the declared value of the traffic in 1876–7. These figures are derived by bringing together textiles of every description, raw and manufactured. In 1876–7 imports exceeded exports by more than three crores. In 1890–1 the exports almost equalled the imports in value, and in 1903–4

they surpassed them by 21 crores. This result is largely due to the prosperity of the cotton and jute mills of India. The exports of cotton yarn and cotton goods were valued at 81 lakhs in 1876–7, and at 10½ crores in 1903–4; the corresponding figures for jute manufactures were 71 lakhs and 9½ crores. Table V (p. 255) shows India's foreign transactions in textiles in 1903–4.

In 1903–4 India possessed 1,422 mills, presses, gins, filatures, &c., concerned with cotton, jute, paper, silk, and woollen manufactures. These give regular employment to more than 400,000 persons, and occasional employment to perhaps double that number. In 1896–7 there were in all 1,084 such factories, so that in seven years there has been a considerable advance. Of the mills, factories, &c., now running, only about forty are worked by hand, animal, or water-power; all the others use steam. Industrial interests.

In the whole field of economic science perhaps no more remarkable example exists of a sudden development than the growth of the cotton industries and trades of Europe and America. The enormous importance of the fibre in the agriculture and commerce of the world at the present day renders it difficult to believe that only a few hundred years ago this, the most valuable of all fibres, was almost unknown to the civilized nations of the West. No less surprising is it that cotton, which has for many centuries been the staple article of clothing of the people of India and other Eastern countries, should scarcely find a place in their early literature. Cotton. History.

Towards the close of the first century of the present era Arrian described Indian cotton as carried by the Arabs from Broach up the Red Sea to Aduli, and he further speaks of extensive trade in the dyed sheets of Masulipatam. The muslins of Dacca were known to the Greeks under the name *gangetika*, a word suggestive of their origin from the banks of the Ganges. Thus it may safely be concluded that in India the arts of cotton-spinning and cotton-weaving were in a high state of proficiency two thousand years ago. Cotton-weaving was only introduced into England in the seventeenth century, and in 1721 an Act was passed prohibiting, in the interests of Manchester, the importation of printed calicoes from India. It may also be mentioned that in 1784 a ship arrived at Liverpool with eight bags of cotton from the United States, which were seized on the ground that so much cotton could not have been produced there. Soon after this the whole aspect of the cotton trade of the world had changed, and

India then fell into a position of very secondary importance. Instead of furnishing Europe with cotton goods she now became dependent on England for her own supplies, a remarkable instance of the triumph of improved mechanical contrivances and intelligent agriculture over hereditary skill and primitive traditions.

The dawn of India's second life in the cotton industries broke with the establishment of the first steam-power spinning and weaving factory; and, as in Europe, that new life meant the gradual annihilation of hand-loom weaving and the concentration of the weavers in the larger towns. Steam factories have sprung into existence all over India, and are yearly being multiplied, while native capital is being poured into them to an extent not experienced in any other Indian industry. It has been estimated that at present £13,500,000 sterling is invested in the cotton mills of India, and that they give employment, directly or indirectly, to 350,000 persons.

Production. The cultivation of raw cotton has been described in chapter i (*Agriculture*); and it will suffice to say here that the production of low count yarn, which for many years was the chief item of India's modern traffic, tended to degrade rather than to improve the quality of the staple. If the manufacturer would pay no more for a long than for a short staple, the Indian cultivator naturally sought to raise the plant that would give the highest yield. It is not surprising, therefore, that within the last thirty years the fine long-stapled cottons of India—the cottons that at one time were much admired, and found a ready sale in Europe—have gradually disappeared, and that a most inferior but highly productive kind has taken their place. That inferior yarns might come to be refused both in India and in China seems never to have been contemplated, yet it may now be affirmed that the future prosperity of the Indian cotton industry will turn very largely on whether or not the Indian cultivator can produce cotton superior to that at present grown.

A little less than half the Indian production is required to feed the steam-power spinning factories of the country. The hand-loom weavers now rarely spin their own yarn, but purchase supplies either of imported or of Indian mill-spun yarn. It may thus be accepted that the balance of production over the demands of the Indian mills is available for the foreign markets. During the past three years the following amounts of raw cotton were exported:—5,700,000 cwt. in 1901–2, 6,045,000 cwt. in 1902–3, and 7,931,000 cwt. in 1903–4. The average value of the exports during the last five years was nearly 15 crores; and

if we assume an equal value for the portion of the crop retained in India, it may be accepted as not far from correct that the total reached 30 crores or about £20,000,000 sterling.

All over the cotton-growing areas large steam-power ginning and pressing mills have been established, to meet local demands and necessities. In consequence the cultivators have discontinued ginning their own cotton, and the evil effect of this in respect to the mixing of seed has already been referred to in chapter i. In 1903 India possessed 895 ginning factories and pressing mills, which gave employment to nearly 75,500 persons. Ginning mills.

The first cotton mill in India was started in 1818, near Calcutta; the first of the Bombay series was established in 1851; and ten years later a dozen mills with 338,000 spindles were at work. In 1879 the number had increased to fifty-six mills with 1,500,000 spindles. In 1886–7 there were ninety mills, with 17,000 looms and 2,203,000 spindles; in 1896–7, 155 mills, with 37,000 looms and 3,984,000 spindles; in 1901–2, 194 mills, with 42,000 looms and 4,992,000 spindles; and in 1903–4, 204 mills, with 46,000 looms and 5,213,000 spindles. Of the mills, eighty-four are in Bombay city and thirty-two in Ahmadābād. Within the decade ending 1903–4, the number of looms increased by 58 per cent. and the number of spindles by 47 per cent. The capital invested in cotton mills has been estimated at about 17 crores; and they give permanent employment to 186,000 persons, besides occasional employment to large numbers of cultivators, carters, boatmen, &c. Between the years 1893 and 1900 the industry was depressed, profits being affected by the disturbance in exchange relations with the Far East which followed the closure of the Indian mints; by over-production; by plague, poor cotton crops, and famine; and by the disturbances in China. Since 1901 there has, however, been a very satisfactory improvement. Spinning and weaving mills.

It has been said of India to-day that 'weaving is for the most part the pursuit of the by-time of the persons who weave.' That is doubtless the condition in many parts of the country; but here and there centres of professional hand-loom weaving still exist, where the village weaver holds an honoured position and turns out a fair portion of the dresses worn by the more conservative and orthodox members of the community. Increased prosperity for these hard-working and deserving craftsmen was held by some writers as likely to ensue when, in 1896, the duty on imported yarn was repealed, while power-loom manufactures, foreign and Indian, remained liable to Hand-loom weaving.

duty[1]. It was thought that all that was necessary, in order to restore the hand-loom industry, was to teach native weavers the use of improved contrivances. It may, however, be safely affirmed that there is nothing either too fine in texture or too complicated in pattern for the power-loom manufacturer to produce, and that his advent on the field is only restricted by the possibilities of profit. The finest Dacca muslins and the most intricate Kashmīr shawls can be, and have been, produced by machinery. But there are still markets eminently suited to the hand-weaver, such as the production of special *sāris* and *lungīs* (women's cloths and turbans) of a particular shape and size, which the power-loom producer does not successfully contest, because the demand is too small or too local.

Long-cloths and damasks.

The artistic cotton products of India may be grouped under two main heads—long-cloths and damasks; and muslins, plain and figured. The cloths turned out are of fine quality, and may be either white or coloured; but the patterns are usually woven, not printed. When checked (and of a thick material) they are, in Northern India, styled *kheses*, and in the south *gabrūns*; when striped they are spoken of as *sūsīs*, and are generally used for women's trousers (*paijāmas*). The usual colours are dark red for Hindus and dark blue for Muhammadans, interwoven in both cases with white. Damask proper is usually much finer, and is generally woven in white only. The following are the chief vernacular terms employed in connexion with cotton cloths. The *dhotī* or *dhotar*, worn by men, is a piece of plain cloth, generally having a coloured border and measuring about 5 yards in length, and 1¼ yards in width. It may be made locally or imported. The *sārī* or women's upper garment varies greatly, according to the wealth, position, or caste of the wearer, as regards the material used and the ornamentation employed. With the finer materials it is generally woven as a gauze, and is still largely hand-loom work. The *sārī* has a larger coloured border than the *dhotī*, or it may be entirely coloured, the pattern being woven into it, or it is of calico, printed or embroidered. Red, blue, and green are the colours most generally used. It is usually worn round the waist, the end being thrown over the head in place of a shawl. The *sārī* is, from an art point of view, perhaps the most picturesque of all Indian garments. The *chādar* or shawl is a sheet usually about 3 yards long and half as wide. It is worn by men, but only by certain classes of women, and is thrown across the shoulders or (by women) over the head.

[1] See Vol. IV, chap. viii, Miscellaneous Revenue (Customs).

The *pagrī* or *lungī* (turban) is a long narrow strip of cloth worn by men round the head. The same material may be worn round the waist as a cummerbund. The *choli* (*khāna*) is a little bodice now largely worn by women below the *sārī*. It is often of a rich material or delicately embroidered. The *sūsī* has already been referred to as the striped cloth used in making trousers, and is often of a beautiful material. If to this list be added the large shoulder-sheet, often quilted, called the *fard* or *razai*; the *lihāf* or *palangposh*, a similar sheet also used as a bed-cover; the floorcloth (*jāzīm* or *farsh*) and the rug (*darī* or *shatranjī*), the series of the principal artistic textile articles of native dress and household use may be regarded as complete.

Cloths of Northern India.

In the Punjab and the Frontier Province beautiful *kheses* are made in the Derajāt and the neighbouring country, especially at Dera Ismail Khān, Jhang, Multān, and Shāhpur. The drills (*gabrūns*) of Ludhiāna closely resemble similar goods from Europe. The *lungīs* of Kohāt and Peshāwar (imitated in Ludhiāna) are famous all over the East; they are mostly in pale drab or dark blue, with richly worked end-pieces in stripes of gold wire and coloured silk. In the *pagrīs* and *lungīs* of Shāhpur and Multān stripes in red, yellow, and green are frequent. A special cloth known as *garbi loi*, made in Gurdāspur, is in request all over India. The glazed *ghāti* fabrics of Jullundur are also well-known.

Of the United Provinces.

The coarser broadcloth of the United Provinces is known as *girant*, *gārha*, or *chandāha*, and the finer goods as *tanzeb*. The best qualities of the latter are made in the Benares, Bulandshahr, Fyzābād, Jaunpur, Mirzāpur, and Rāe Barelī Districts. The *kanāwez* or double pattern fabrics of Alīgarh are very beautiful; and the checked and striped *gabrūns* from Agra (locally known as *nākhūnas*) still enjoy some reputation, though they have suffered seriously from the competition of imported goods. The damasks of the Rāmpur State have a considerable local market, and are admirable of their kind.

Of the Central Provinces and Berār.

The most famous cloths of the Central Provinces are those of Umrer in Nāgpur District, and of Paunī in Bhandāra. Their chief product is *dhotīs*, the glory of which is the breadth and beauty of the borders. Nāgpur contains one of the most successful of the cotton mills in India, which turns out good *dhotīs*, but unfortunately without the artistic borders of former times. Among the most delicate of the *sārīs* are those of Burhānpur, with variegated borders interwoven with gold-plated thread. The flower-bordered *sārīs* of Sambalpur are called *phūlia*; and

peculiar to this District are the *sāris* known as *hansabali*, bordered or striped with fantastic animal designs. These *hansabalis* are perhaps the most artistic product of the Central Provinces. The Akola and Ellichpur Districts of Berār are known all over India for their cotton goods, more especially checked and striped handkerchiefs, which are worn round the head or waist. Their chief beauty consists in the rich shades of red used in colouring the yarn.

Of Bengal. Cossimbazar, Chittagong, Patna, and Sāntipur (Nadiā District) have been famed for their cotton goods since the East India Company had factories in these places, but the business is at present purely local. Tippera has a fairly large trade in cotton-weaving; and Dacca, famous for its fine muslins, still holds a foremost position among the Bengal centres of cotton-spinning and weaving. The damask broadcloths of Jahānābād (Patna District), Rangpur, and Dinājpur have a fair reputation.

Of Bombay. In the Bombay Presidency, Belgaum and Dhārwār are noted for their fine *sāris*, which have bold silk borders and beautiful end-pieces; and the *sāris* of Bijāpur are also of high quality. Nāsik is famous for its turbans, especially those produced at Yeola. *Lugadis* of cotton and silk mixed, or cotton with silk borders, are also largely made there. *Sūsīs* are extensively produced in Thāna. The cotton manufactures of Bombay city fall under the head of ordinary commercial rather than of artistic goods, and the same may be said of Ahmadābād; but the hand-loom *dhotars* and *chalotas* of the latter place have pretty silk borders and find a market all over the Presidency. Surat turns out superior *lungīs*, *sārīs*, and *sūsīs*, while Broach gives attention to *razais*.

Coarse cloth (*dangari*) is manufactured in every village in Sind, and *sūsīs* at Hāla in Hyderābād District. Hyderābād itself is famed for its *agattis* or strings for supporting trousers: these are rainbow-coloured for men and of a fair gauze texture for women. It also turns out cheap *kheses* of an exceptionally rich quality, woven in red and green or red and yellow cotton, the weavers of this class of article mostly residing at Narapur. Tatta used to be renowned for cotton chintzes as well as silk goods, while Karāchi has some credit for its *lungīs*, *kheses*, and *sūsīs*.

Of Madras, Mysore, and Burma. In Godāvari District certain villages round Cocanāda and Rājahmundry have a high reputation for their cotton goods. The blue *palampores* and fine shirting cloths of Nellore were at one time largely exported to the West Indies, but this trade was ruined through the emancipation of the slaves

freedmen refusing to buy articles which they regarded as symbols of their former slavery; and of all the ancient seats of cotton-weaving in Southern India, Rājahmundry is the only one that to-day occupies a fairly assured position. The painted chintzes of Masulipatam, Kālahasti, and Madura have already been mentioned.

In Mysore good damask broadcloths are turned out, especially at Bangalore; the chintzes of Shimoga, and the printed cloths of Bangalore, are similar to those formerly produced at Seringapatam.

In Burma, as in Assam, weaving is a domestic industry, carried on mainly by women.

Dacca muslins.

The fine muslins of Dacca have been famed for centuries. An exhaustive account of them, written by Dr. James Taylor, was published in 1851. The skein of yarn which a native weaver measured in his presence, says Dr. Taylor, proved to be 250 miles in length to the pound of cotton. A popular method of testing fineness was to ascertain if the cloth produced would pass through a lady's ring. Speaking of the very fine yarn produced in Dacca, Dr. Taylor further explains that the shortness of the staple renders it unsuited to machine-spinning, but nevertheless the local spinners are able to produce with it the same results as from the finest long-stapled cottons of America. The tendency of the fibre to expand with moisture is the criterion by which the native spinner judges of the suitability for fine, that is exceptionally high count, spinning. English yarn swells on bleaching, while Dacca spun thread shrinks and becomes stronger the more frequently it is subjected to that process. It would thus appear that the European spinner may still have something to learn from the hand-worker which might possibly lead to spinning shorter staples than are at present considered indispensable. Some of the finer Dacca muslins are woven of yarns that measure 400's[1], but higher counts than these have been produced in Europe, so that beautiful though the fine muslins of Dacca, Arni, Chanderī, Kotah, Rohtak, Benares, and other localities may be, they are not superior in fineness to muslins that can be made in Europe.

Jāmdāni work of Bengal.

Figured or flowered muslins (*jāmdānis*) are, from an art point of view, the best products of Bengal. These are literally cotton brocades, the pattern or flower being formed by spools carrying special threads of cotton, silk, or gold that are thrust

[1] Cotton yarns are said to be of 20's, 30's, &c., counts when not more than a like number of hanks of 840 yards go to the pound avoirdupois.

by the hand within the warp, and are thus supplementary to the weft. It would take many pages to describe the chief designs met with; it must suffice to say that they are strongly Persian in feeling and conception. The fabric is usually grey cotton, ornamented with blue-black designs, or occasionally with brightly coloured cottons, and gold or silver wire. When made in the form of *sārīs* the ends have large bold corner-pieces. Dacca is the most famous centre for *jāmdānis*. Coloured *sārīs* with brightly coloured (*jāmdāni*) flowers are produced at Sāntipur in Nadiā District, and elsewhere in Bengal, and are sold extensively at Howrah; the coloured *sārīs* of Tippera also deserve mention.

Muslins of the United Provinces and the Punjab.

In the United Provinces, Sikandarābād in Bulandshahr District, Mau in Azamgarh, Mahmūdnagar in Lucknow, Jais in Rāe Barelī, Tāndā in Fyzābād, and Benares are famous for their plain, striped, and flowered muslins, the *jāmdānis* of Tāndā being of special excellence. In the Punjab, muslins used to be largely produced at Delhi and are still made at Rohtak.

Of Rājputāna and Central India.

Among the muslins of Rājputāna the foremost place is held by those of Kotah. Chanderī, in Gwalior, and the town of Gwalior itself turn out high-class goods. Those of Gwalior are usually checked and figured, while the border of the Chanderī muslins is in silk or gold, the silk being double woven so as to show a different colour on each side. Indore and Sārangpur (Dewās State) produce unbleached muslins of considerable beauty.

Of Madras.

Arni, in the North Arcot District of Madras, is well-known for its fine muslins (though they are not so fine as those of Dacca), but the demand for these goods has declined very seriously of late years. Other Madras muslins with a local reputation are those of Adoni, Madura, and Tanjore. The Venkatagiri muslin (white with gold or coloured bands) is mostly used for turbans.

Twist and yarn.

In 1903–4 the mills of British India produced 556,000,000 lb. of yarn, or about 100,000,000 lb. more than in 1897–8, and those in Native States 22,500,000 lb. Of the total production, three-quarters of which is in the Bombay Presidency, about 104,000,000 lb. (or 18 per cent.) were higher counts, that is to say, qualities above 20's. One of the most significant features of the modern traffic in Indian cotton manufactures is this increase in the out-turn of the higher count yarns, for which a good deal of Egyptian raw cotton is imported. The production of these counts in 1903–4 was 42,000,000 lb. in excess

of that only five years previously. By way of contrast with this prosperous Indian industry, it may be pointed out that the weight of twist and yarn imported in 1888–9 was 52,500,000 lb.; in 1898–9 it had fallen to 45,500,000 lb., and in 1903–4 to 28,000,000 lb. It would thus appear that the imports are steadily declining with the growth of the Indian production of higher-class yarns.

Turning now to the exports of Indian twists and yarns, in 1876–7 these amounted to 8,000,000 lb., valued at 37 lakhs, and in 1903–4 to 252,500,000 lb., valued at about 9 crores. Deducting the exports from the total production it appears that in the latter year 326,000,000 lb. of Indian yarn and 28,000,000 lb. of imported yarn were available for Indian power and hand-looms. It seems fairly certain that, but for the exports of raw cotton and the existence of the Indian steam-power mills, the area of cotton cultivation in India would be reduced to about one-quarter its present extent. One-half of the total production is exported raw and one-quarter in the form of yarn, thus leaving the remaining quarter to meet local demands.

Piece-goods, &c.

The woven goods produced by the Indian mills amounted to 99,000,000 lb. in 1898–9 and to 132,000,000 lb. in 1903–4. These goods are mainly grey unbleached cottons, 80 per cent. being of that nature. The proportion of higher-class goods varies in different Provinces. In 1903–4 Madras returned nearly 64 per cent., the Central Provinces (including Berār) 28 per cent., and Bombay 18 per cent. of the total manufactures as white and coloured goods, hosiery, &c. The grey goods represent about 4 yards to the pound in weight, so that the Indian mills manufactured about 315,000,000 yards of grey goods in 1897–8, and about 436,000,000 yards in 1903–4. Turning now to the imports, India received, in 1903–4, 1,085,000,000 yards of grey piece-goods, 466,000,000 yards of white goods, and 481,000,000 yards of coloured and printed cotton goods. Deducting re-exports, this gives 1,966,000,000 yards available for India, *plus* 326,000,000 yards of Indian production (deducting exports from total out-turn); and we get in all 2,292,000,000 yards as the net Indian supply for 1903–4.

While the Indian mills are spinning very largely for China and other foreign markets, the looms are far more concerned with the home market.

Jute. History.

Perhaps the earliest botanical writer who investigated the cultivation of jute (*Corchorus olitorius* and *C. capsularis*) in Bengal was Dr. Buchanan-Hamilton. In 1801 the East India

Company were anxious to discover a good substitute for hemp. Buchanan-Hamilton had apparently advocated the claims of the *san* fibre for that purpose, and accordingly wrote of jute: 'Whether or not this plant might be employed in Europe to make cordage or canvas, I cannot say; but I hope that no circumstance will divert the attention of the public, until a fair trial has been made of *san*.' Buchanan-Hamilton had not a very high opinion of the jute fibre, which was then unknown to Europe, although grown and used in Bengal. From the writings of other authors we learn that a century ago the poor in Eastern and Northern Bengal were mainly, if not entirely, clad in a sackcloth of jute. Such a state of affairs has quite passed away in the India of to-day, the poorest peasant being dressed in cotton.

It would seem probable that Dr. Roxburgh was the first person to use the word 'jute' for this fibre. According to some writers the word is derived from the Sanskrit *jūta*; others trace it from the well-known waste silk, *jhūtajhūt*; and a third opinion derives it direct from *jhot*, the Orissa name of the plant. The word *pāt*, used by Buchanan-Hamilton, is the ordinary Bengali name for the plant from which the jute fibre is derived. But the term *pāt* or *patta* appears all over India, and is given first to one fibre and then to another, its most general acceptation being silk. A common synonym for *pāt* is *rājā sana*, the noble *san* fibre. The term 'gunny' (the name used in modern commerce for jute sacking) is doubtless derived from *gānja* (by the earlier authors written *gānia*), and thus links the jute plant with hemp, and shows that, so far as India is concerned, the use of jute is modern, being indeed to this day practically unknown in any Province outside Bengal and Assam. In the trade returns for India the imports under the name of hemp refer to the true hemp, while the exports so designated are mainly, if not entirely, *san* (the fibre of *Crotolaria juncea*).

Industrial aspects.

Jute fibre was first experimented with by Europeans in 1820, the result being so unfavourable that brokers were for some years subsequently required to give a guarantee that sales of fibre effected by them were free from adulteration with jute. One of the earliest commercial references to the fibre occurs in the Customs returns of 1828. In that year 364 cwt. of raw fibre, valued at Rs. 620, were exported to Europe. The manufacture of gunny bags and cloth was at that time entirely in the hands of the Bengal peasant weavers, but the traffic could not have been very extensive. In 1832 an enterprising

Dundee manufacturer experimented once more with the fibre, and was able to show that it might be used as a substitute for hemp. From that date jute gained rapidly in popular favour. It was recognized that it was capable of the most minute separation, but it is only within the past few years that this advantage has been utilized for the finer textile purposes. In time the difficulty of bleaching and dyeing the fibre disappeared; and the success of jute being thus assured, the foundation of the manufacturing enterprise of Dundee and Calcutta was laid.

With the establishment of jute mills at Dundee, a large export traffic in the raw fibre sprang into existence at Calcutta. Until 1854, when the supply of flax and hemp from Russia was cut off by the Crimean War, little or no effort was made to organize mills in India, or to improve the village hand-loom production, with a view to participating in the new demand of foreign countries for jute sacking. In that year, a factory was established at Serampore, and some years later factories sprang up rapidly in and around Calcutta, until the banks of the Hooghly are now dotted with smoking chimneys. In 1891–2 there were twenty-six jute mills, with a capital of 137 lakhs, *plus* £1,757,000 in sterling; and these contained 8,295 looms, with 173,000 spindles. In 1903–4 there were thirty-eight mills, with a capital of 743 lakhs, including a sterling capital of £2,263,000; and these contained 18,406 looms and 376,718 spindles, and gave employment to 124,000 persons. While the English capital of the Bengal jute industry has not advanced much, recent years have witnessed an immense expansion of the capital subscribed in India.

Practically every homestead in the jute tracts has a few bundles of jute suspended from a beam in the roof of the veranda. The fibre is spun into twist or yarn, and worked up as required into string and rope, or is woven into gunny cloth or bags. Year by year, however, this domestic craft has decreased, and it may safely be affirmed that the decline in hand-loom jute weaving is far greater than in the case of cotton. In fact, hand-loom gunnies have now practically disappeared from the market; and yet so late as 1880–1, the returns of foreign exports had to be divided into two sections, power-loom and hand-loom. Hand-loom weaving and presses.

The jute presses are concerned with the foreign trade in raw jute. In 1896–7 there were eighty-eight such presses, and in 1903–4 155 presses with 21,000 employés.

It has already been stated that in 1828 the exports of raw Trade.

jute were only 364 cwt.; in 1832–3 they were only 11,800 cwt.; fifty years later they had expanded to 10,349,000 cwt.; and in 1903–4 they were 13,721,000 cwt., valued at nearly 12 crores. From the jute taken by the Indian mills, goods to the value of 9½ crores were exported in 1903–4, and it is probably correct to suppose that this represents about two-thirds of the total manufactures of these mills: hence the total value of the Bengal jute production, including raw material exported, may be estimated at about 27 crores. Recently the exports of jute cloth have been progressing at a higher ratio than those of bags, which is possibly due to the utilization of the cloth in linoleum manufacture. In 1903–4 the United States took 63 per cent. of the jute cloth exported, while Australia is the largest single market for bags.

Paper-making. Paper was introduced into India by the Muhammadans, who had learned its use from the Chinese. To the present day, wherever paper-making by hand is still practised, the workers are usually Muhammadans; but the industry has long been declining, and only the coarsest kinds of paper are now produced. Among Hindus, the earliest writing materials were palm-leaves in the south (where they are still commonly used), and birch-bark in the north. The oldest Sanskrit MSS. on paper come from Kashmīr and Nepāl, no doubt under Chinese influence. But, although the process by which paper could be made was fully understood, no progress was made in India until Europeans organized the present industry with the help of modern appliances. The most valuable paper materials are old rags, waste gunny-bags, jute and *san* (hemp) cuttings, and *bābar* and *mūnj* grasses.

There are nine paper mills in India—four in Bombay, four in Bengal, and one in the United Provinces (Lucknow); and, so far as can be ascertained, the capital invested in these is 65 lakhs. In 1903 they gave employment to about 4,500 persons and produced nearly 44,000,000 lb. of paper, valued at 59 lakhs.

Printing. The associated industry of printing may be very briefly mentioned here. In 1898 India possessed 756 printing presses; in 1900–1 there were 876, employing about 19,000 persons. Since 1901 the smaller presses have been excluded from the returns, and in 1903 the 107 large presses employed 13,220 hands.

Silk. History. Many conflicting opinions have been advanced on the history of the silk industry of India. It is probably correct that the most ancient references to silk by Sanskrit authors

denote one or other of the non-domesticated worms, and not the true silkworm (the mulberry-feeding insect) of modern commerce. All the passages that speak of the mulberry-worm in early Hindu literature refer to an imported, and not to a locally produced, silk. Neither this worm nor the plant on which it feeds has ever been found in an indigenous condition in India—certainly never in the parts of India where sericulture exists. The practical silence of Muhammadan writers on the subject is also significant, and tends to the conclusion that until the advent of the East India Company mulberry silk-growing was nowhere an important industry in India. Under the fostering care of the Company, however, the Indian silk trade prospered greatly, and the experiments then conducted resulted in the introduction and adaptation of at least some of the sub-tropical races of the silkworm now met with in Bengal. For example, the *desi* or cold-weather *band* (*Bombyx fortunatus*), and the *nistri* or rainy and hot-weather *band* (*B. croesi*), may have displaced the now neglected *sīna* or *hotā pāt* (*B. sinensis*), and the *boro polo* or *boro pāt* (*B. textor*). In Burma the worm met with is the *nyapaw* (*B. arracanensis*).

In the seventeenth and eighteenth centuries India's chief competitor in the silk trade was the Levant Company. Gradually, however, successful efforts were made to acclimatize in Europe one or two races of a temperate worm, procured from China and Japan. This might be described as *Bombyx mori* proper. When sericulture became part of the agriculture of France and Italy, a quality of silk was produced entirely different from that of India and Turkey, and its appearance created a new demand and organized new markets. All subsequent experience seems to have established the belief that the plains of India, or at all events of Bengal, are never likely to produce silk that could compete with this new industry. On the lower hills of Northern India, on the other hand, a fair amount of success has been attained with this (to India) new worm, as, for example, in Dehra Dūn and Kashmīr. In Manipur, it would appear probable that *B. mori*, possibly obtained from China, has been reared for centuries. The caprice of fashion has, from time to time, powerfully modified the Indian silk trade. The special properties of the *korah* silks were formerly much appreciated, but the demand for them has now declined. This circumstance, together with defective systems of rearing and of hand-reeling and weaving, accounts largely for the present depression in the mulberry silk trade of India.

Wild silks. India has three well-known purely indigenous silkworms: the *tasar*, the *mūgā*, and the *eri*. The first is widely distributed on the lower hills, more especially those of the great central table-land, and feeds on several jungle trees. The second is confined to Assam and Eastern Bengal, and feeds on a laurel. The third exists in a state of semi-domestication, being reared on the castor-oil plant. From an art point of view the *mūgā* silk is the most interesting and attractive, and the cocoon can be reeled readily. The *eri* silk, on the other hand, is so extremely difficult to reel that it is nearly always carded and spun—an art which was practised in the Khāsi Hills of Assam long before it was thought of in Europe.

Area of production. In Bengal mulberry silk-culture centres in the Districts of Murshidābād, Mālda, Rājshāhi, and Burdwān. In Chotā Nāgpur the *tasar* is fairly plentiful; and in the northern tracts, such as Rangpur, Jalpaiguri, and Bogra, the *eri* silk is largely reared. The mulberry worm is also regularly reared in the Manipur State. The silks of the Assam Valley proper are the *mūgā* and *eri*. In the United Provinces mulberry silk is produced in Dehra Dūn and Partābgarh, and in southern Mirzāpur the *tasar* is found. In the Punjab and Frontier Province mulberry silk occurs in the Kohāt, Peshāwar, Gurdāspur, and Kāngra Districts, and in Kashmīr it has recently become established as an important industry. The silk of the Central Provinces is the *tasar*, which is fairly abundant in the forest tracts. Bombay is noted for its silk manufactures. In the seventeenth century it drew its supplies of raw silk from Persia and Bengal, but at present these come from China. Several attempts have been made to acclimatize mulberry silk in Madras, but to no purpose. In Mysore the industry appears to be very ancient. Dr. Buchanan-Hamilton describes it at the beginning of the nineteenth century. A small mulberry silk industry has always existed in Prome, and to a less extent in other districts of Burma. The European standard (tree) system of mulberry cultivation is followed in Northern India, and has been recommended as superior to the bush system of Bengal. In Bogra and some other parts of this Province which are subject to inundation, the mulberry beds become elevated ridges within rice-fields.

Filatures, mills, &c. Bengal is the chief producing Province of India, while Burma and the Punjab use the largest quantities of silk. But it is significant that the Bengal production influences but slightly the manufacturing centres of India. As already stated, Bombay imports its supplies from China, and distributes raw

silk thus obtained to Northern and Central India. All but one of the silk filatures of India are located in Bengal. In 1891 there were eighty-one, and in 1903 these had decreased to sixty-three, which gave employment to 9,000 persons. Three large silk mills (two in Bombay and one in Calcutta) are worked by steam-power and are almost exclusively concerned with the Burmese market, a trade that was formerly concentrated very largely in Glasgow but is now shared by Japan. There are also some twenty to thirty hand-loom factories, mostly in Bengal. The Bengal factories of to-day largely work up *tasar* silk, in place of preparing the *korah* silks formerly turned out by them: they are owned and managed by natives and do not employ European machinery. Besides the registered mills and factories, numerous weavers own one or two looms worked by themselves and their families. Silk-weaving seems intimately associated with Gujarāt. From one end of India to the other Gujarātī silk-weavers may be found, speaking a dialect of Gujarātī or using Gujarātī names for most of their appliances and for the textiles they produce.

Artistic manufactures and chief centres of production.

The following classification of the most important artistic silk textiles of India may help to convey some conception of their diversity and beauty :—

(*a*) *Gold brocades or kincobs* (*kamkhwābs*). These are silk textiles the pattern of which (more or less elaborated with gold or silver wire) is supplementary to the weft, and is consequently thrown on the surface of the fabric. It is produced by special spools thrust between the warp by hand. It is customary to restrict the word 'kincob' to a brocade in which there is a liberal use of metallic thread. Cloth of gold may be viewed as woven entirely of gold wire, the pattern being sometimes produced by punching the surface, while in the kincobs proper silk is used as a body material or to outline the gold materials or the gold patterns. *Bāftas* or *pothāns* have the major portion of silk and the patterns only in metallic wire. Lastly, *āb-rawāns* are silk gauzes with gold or silver threads interwoven. Both cloth of gold and kincob are mentioned in the Vedas. Megasthenes, speaking of the costumes of the princes of India, remarks that their robes were worked in pure gold, and the rich stuffs brought from India to Babylon were probably gold brocades of the kinds now produced at Ahmadābād, Benares, and Murshidābād. It would appear too that the kincobs, which are now mainly used for trappings and curtains, were originally woven of pure gold, and that silk was added to give a body to the textile and to afford a means of colour illumina-

tion. The centres most famed for this beautiful and ancient art are Benares, Agra, Ahmadābād, Baroda, Surat, Burhānpur (in the Nimār District of the Central Provinces), Aurangābād, Raichūr, Tanjore, and Trichinopoly.

(*b*) *Amrus, or silk brocades without gold or silver wire.* These are produced at Murshidābād (*būtadār* or flowered *sārīs*), Benares, Multān, Bahāwalpur, Nasatpur (Sind), Ahmadābād, Surat, Yeola, Poona, Aurangābād, Raichūr, and Tanjore. The most characteristic textiles of this kind are, however, those woven in cotton but spun so as to form a soft thick fabric that feels like wool, and has silk patterns brocaded over the surface. These are styled *himrus*. They are as a rule lined, and when made up into coats for men, and bodices and trousers for women, are, as the name denotes, suitable clothing for the cold weather. Aurangābād is the chief centre of *himru* production, though Trichinopoly has a fair share in the industry. The *himrus* of Ahmadābād, Surat, and Raichūr may also be mentioned. In point of texture and durability few Indian fabrics appear so directly suited to European purposes as the *himrus*. Like kincobs, they might be extensively used for wall drapings and curtains, while some of the finer qualities could be employed for ladies' dresses, and others for men's ties and fancy waistcoats, or even for dressing-gowns.

(*c*) *Sangi*, *gulbadan*, and *mashrū* are names given to various silks that resemble each other in containing a wavy stripe. *Mashrū* has already been referred to on p. 187. The *sangi* silks have a wavy pattern (*khanjarī*). The *gulbadan* is a light fabric with a somewhat similar pattern, which is, however, woven within the texture, and not thrown on the surface as in *sangi*. Pure silks, or silks mixed with cotton that answer to this name, are produced all over Northern India and were at one time extremely popular. But the competition with imported goods has been very injurious to the indigenous craft, and the cheaper and more attractive *sangis* have also replaced the older and more expensive *gulbadan* work. Goods of these various classes are produced at Azamgarh, Benares, Allahābād, Alīgarh, Agra, and Bulandshahr in the United Provinces; also at Amritsar, Bahāwalpur, Tatta, and Yeola.

(*d*) *Striped and checked* (*washing*) *silks*. These are known as *dariyais* (plain silk), *gardahs* or *gulbarras* (silk of fine counts), and by other names. The chief centres of production are Amritsar (*dariyai*), Multān, and Bahāwalpur, in the Punjab; Agra, Azamgarh, Mirzāpur, and Benares, in the United Provinces; Murshidābād (*korah* and *matka* silks), and Bānkurā

(noted for double-coloured silk *sārīs*), in Bengal; Karāchi, Tatta, Surat, Poona, Yeola, and Thāna, in the Bombay Presidency; Berhampur (Ganjām), Madura, and Dindigul, in Madras.

(*e*) *Satinettes* (*ghattas, kanāwez, &c.*) are made principally in the Azamgarh District of the United Provinces; at Peshāwar; at Ahmadābād and Surat; and at Ariyalūr (Trichinopoly District) and Ayyampettai (Tanjore), in Madras.

Other silk products that may be specially noted are the fine *lungīs* of Peshāwar, Kohāt, and Bahāwalpur, the embroidered silks of Kashmīr, the silk *sārīs* of Kotah and Chanderī (Gwalior), and the *patola* silks of Gujarāt (see p. 187).

The silk *sārīs* of Kāthiāwār, especially when embroidered, are hardly equalled in India for finish and delicacy of colour. The coloured silk *sārīs* of Arni (Madras Presidency), with deep embroidered borders and geometrical scrolls, also deserve mention. There is a large demand for silk garments in Burma, but the local products, whether plain, striped, checked, or brocaded, are not equal to those of India. The silk industry of Burma is due to colonies of Manipurīs whose ancestors were taken captive by former Burman kings. Bombay and Murshidābād produce silks for the Burma market.

The first consignment of wound silk from India to England was made in 1772, but during the five succeeding years the exports did not on an average exceed 180,000 lb. From 1776 to 1785 the average came to 560,000 lb., the supply from Turkey, Italy, &c., being only about one-half that amount. In 1790 the exports of thrown and raw silk were 1,266,000 lb. From 1857, when the utilization of waste silk began in Europe, the exports of India changed their character: the waste and wild silk trade improved, and that in reeled silk declined. In 1876–7 the total exports were 1,418,000 lb., valued at 78 lakhs. In 1880–1 they were 551,000 lb. reeled silk, *plus* 788,000 lb. waste and *chasam*, valued at 55 lakhs. In 1900–1 the figures were 560,000 lb. reeled and 1,031,000 lb. waste, total value 51 lakhs; and in 1903–4 the corresponding figures were 624,000 lb. reeled silk and 1,137,000 waste, total value 63 lakhs. The exports of manufactured silks have shown a still more serious decline: in 1886–7 they were valued at 32 lakhs, in 1896–7 at 16 lakhs, and in 1903–4 at only 8 lakhs. Trade.

In both raw silk and silk manufactures India now receives far more than she gives. The imports of raw silk were, in 1876–7, 1,461,000 lb., valued at 45 lakhs: twenty-five years

later (1900–1) they were 2,535,000 lb., valued at 102 lakhs. There has since been a temporary decline, very possibly an after consequence of famine and plague, the imports in 1903–4 having been 1,544,000 lb., valued at 59 lakhs. The imports of manufactured silks show a remarkable expansion. In 1876–7 these were valued at 58 lakhs, and five years later at 35 lakhs. In 1903–4 they rose to 183 lakhs, the highest figure yet attained. Thus not only is India failing to produce silk goods suitable for the demands of other countries, but she is opening her own markets to a foreign competition that must tell disastrously on the local hand-loom workers.

Wool and *pashm*.

The earliest classic writers of India knew of wool, which was assigned as the material for the sacred string of the Vaisya caste. The discovery of the art of felting possibly preceded that of spinning and weaving the fleece. Wool, however, takes a very subordinate position in the art crafts of the plains of India, owing largely to its unsuitability as a material of clothing under the climatic conditions. The wool of the Indian sheep is very inferior to that of Europe and Australia. It is short-stapled, and so deficient in the scaly quality valuable for felting as to resemble hair rather than wool. Whether it be possible to remove these defects, with sheep living under tropical conditions, is a point of the greatest uncertainty: at all events the recent expansions of the wool trade of India have been in regions known to produce woolly fleeces.

Pashm or *pan* is the undercoat of wool found on certain goats in Tibet. This is the article employed in the manufacture of Kashmīr shawls (*shāls*), Rāmpur *chādars*, and *pashmīna* cloth. Of late years a soft form of wool has been imported into India from Kermān in Persia. More recently a similar wool has come from Australia and other countries, and later still a soft staple has been produced by special treatment of almost any wool. These and similar substitutes for the true *pashm* are imported into Bombay and carried to Amritsar, Lahore, Nūrpur, Ludhiāna, and even to Kashmīr itself, and, either in their pure state or mixed with a small amount of Tibetan *pashm*, are made into shawls, dress pieces, &c., and then sold all over India, and even exported to Europe and America, as true *pashmīna*. The name 'cashmere' is also given to cloth woven in Europe, and has in fact become a trade term for a certain quality of fine soft woollen goods. It is possible that the entire supply of Tibetan *pashm* does not represent a tithe of the material, raw or made up, now

sold under the names of *pashmīna* or 'cashmere' in Europe and America.

Centres of production.

The best wool in the Punjab and Frontier Province is probably that of Hissār District; but Ferozepore, Lahore, Jhang, Shāhpur, Peshāwar, Dera Ismail Khān, Amritsar, Multān, Rāwalpindi, and Jhelum each produce wool in fair quantity and quality. In the United Provinces the most useful wool comes from the Himālayan tracts—Garhwāl, Almorā, and Nainī Tāl—while the important Districts in the plains are those of Agra and Mirzāpur. A large drain is, however, made on the Punjab, Rājputāna, and Sind, and on foreign countries, to meet the manufactures of these Provinces. The best-known local wools of Western India are the black Deccan and Khāndesh; and the white wools of Sind, Gujarāt, and Kāthiāwār. Sind and Baluchistān wools are exported from Karāchi, along with the fine wool obtained from Bīkaner. The rearing of sheep in the Central Provinces is fairly important in Jubbulpore, Nāgpur, Chānda, Wardhā, and Raipur. In Rājputāna and Central India, Bīkaner, Jodhpur, Jaipur, and Ajmer produce wool, and that of Bīkaner is much prized all over India, especially for carpet-weaving. In Southern India the wools of Bellary, Kurnool, Coimbatore, and Mysore are well-known; but the sheep of most other Districts of Madras, like those of Bengal, yield hair rather than wool.

Manufactures and mills.

Woollen manufactures consist of coarsely woven or felted blankets and piece-goods, only occasionally ornamental. The manufacture of felts (*namdās*), which are made of spun wool, and used as bed and floor rugs, and for horse-cloths, is carried to a considerable degree of excellence in Kashmīr; Bannu, Hazāra, Dera Ghāzi Khān, and Bhera; Bahraich; Gujarāt, Jodhpur, Jaipur, Sind, and Baluchistān. Kashmīr felts are richly embroidered; those of Kohāt and Bannu have coloured wools imbedded in the felt in elaboration of some design. It is only in Northern India (more especially in Kashmīr) that the spinning and weaving of wool extends to the production of highly finished and artistic goods. It must suffice to deal in the most general terms with two groups—the Kashmīr shawls and *chādars*, and the woollen-pile carpets of India, and to add some remarks on embroidery. Before doing this it may be mentioned that there are at present only six steam-power woollen mills in India: namely, at Cawnpore, Dhāriwāl in the Punjab, Bombay (3), and Bangalore. The capital invested in these mills is 45 lakhs, of which the Cawnpore

mill has nearly one-half. They possessed 678 looms and 25,000 spindles in 1903, and employed 3,000 people. The out-turn includes blankets, serges, broadcloth, flannels, hosiery, cardigan jackets, jerseys, gloves, &c.; also tweeds, shawls, worsted, and Berlin wool. Their total production in 1903 was about 3,000,000 lb., valued at 29 lakhs. But for all the higher-class goods they have to import Australian wool, which is used either pure or mixed with Indian wools.

Scattered here and there all over the country are various hand-loom factories where coarse blankets, carpets, rugs, *pattū*, and *pashmīna* are produced. *Pattū* (puttoo) is a fabric woven of wool or goat's hair, treated so as to resemble *pashm* or a mixture of *pashm* and cotton. Though the industry is considerable, the factories are individually small. Eleven of the larger hand-loom establishments, mostly concerned in the carpet trade, give employment to about 4,500 persons.

Pile carpets.

Pile carpet-weaving as now practised in India was introduced, like many other arts, from Persia; but it is probable that India had a carpet industry of its own (though possibly not in pile carpets) long before the advent of Persian influence. Methods and designs are met with in the Indian carpet trade which are very possibly indigenous, and include the peculiarities by which Indian carpets can be at once distinguished from those of other countries. There is little or nothing to show that the princes and nobles of India used woollen-pile carpets in the past more extensively than they do at present. In a tropical country sumptuary desires are more naturally met by gold *masnads* than by expensive carpets; but where carpets are used in India they are almost invariably of a good quality and rich oriental design, and are procured not merely from India itself, but from Turkey, Turkistān, Persia, and Afghānistān. Cheap carpets are exclusively made for export, the present demand being the outcome of the interest aroused by the carpets sent from India to the London Exhibition of 1851. The idea seems then to have occurred to European dealers that, if a cheaper article could be produced by India than was procured from Turkey and Persia, a large and profitable trade might be organized. Patterns were accordingly sent out, the quality prescribed, and the price fixed at an almost impossibly low figure. The result could hardly have been other than a steady deterioration in quality and artistic merit. Another influence, but in the opposite direction, has been exercised by the famous book on Oriental Carpets published by the Austrian Commercial Museum. From one

end of the country to the other, the plates of that work, either in original or as copied by Indian draughtsmen, are to be seen in the factories of even the humblest workers. This has tended to raise the tone of carpet-weaving in India, and thus to arrest the disastrous results of the trade demand already spoken of; but it has also operated to destroy the little distinctions that formerly existed between the chief centres of manufacture. The production of carpets at some of the large Indian jails has sometimes been referred to as exercising a debasing influence on the artistic industry. This is not the fact, the work of the jails having been on the whole distinctly beneficial. The Yeraoda jail at Poona, for example, in reproducing rich and pure designs obtained from old carpets at Bijāpur (probably of Kashmīr make), has conserved what might otherwise have been lost.

Carpet-weaving in Northern India.

The centres of carpet-weaving in Northern India are, in order of importance, Amritsar, Kashmīr, Lahore (jail), Multān, Hoshiārpur, Batāla, and Bahāwalpur. In Kashmīr, carpet-making has been practised for several centuries, and the Kashmīr carpets were known of old even in Southern India. The large and prosperous industry at Amritsar appears to be quite modern, and is mainly in the hands of Hindus. Central Asia and the Native States of India are ransacked for old choice patterns, while the utmost care is taken in the selection of warp, wool, and vegetable dyes. *Pashmīna* wool is used for the finest descriptions of carpets, and the work is all done by hand. The carpet-weaving of Hoshiārpur and Batāla is a recent offshoot from Amritsar. Multān is an old centre, and the industry is said to have been established there prior to the introduction of carpet-weaving from Persia. It is probable, however, that the original influence came from rugs and carpets brought from Turkistān. The Multān carpets are marked by the size of the stitch and an aggressive colouring, while they are usually disproportionately long in relation to their breadth. The Bahāwalpur carpets do not differ materially from those produced at Multān. Peshāwar, and to a less extent Quetta, are centres for the Afghān, Turkomān, and Persian carpets that find their way into India. Kohāt, Bannu, and a few other places along the north-western frontier produce a peculiar form of rug called a *nakhai*, the distinctive feature of which is that the weft threads protrude, in twisted loops, from the warp strands.

In Sind and Baluchistān.

The carpets manufactured in Sind closely resemble those of Multān. Sir George Birdwood (*Industrial Arts of India*)

describes them as 'the cheapest, coarsest, and least durable of all that are made in India.' Speaking of Baluchistān, he continues: 'The carpets and rugs are made of goats' hair, which gives them their singularly beautiful lustre, finer even than that of the Indian silk carpets, and more subdued in tone, although the dyes used in Baluchistān are richer. The patterns are usually of the fantastic geometrical character found in Turkomān rugs, from which the patterns of the early "Brussels carpets" were derived.' These carpets are, however, rarely made in Baluchistān itself. They come from Seistān, and, to a less extent, from Afghānistān.

In United Provinces and Bengal.

The excellent carpets made in the Central jail at Agra furnish a further refutation of the usual condemnation of Indian jail-made carpets. Mirzāpur is another well-known carpet centre in the United Provinces. Bengal has no good wool, and the only carpets that need be mentioned are those from Gayā. While poor in quality, these possess an individuality that recalls the Rāmchandra carpets of Ellore.

In Rājputāna and Central India.

Carpet-weaving has flourished for many years in Rājputāna and Central India. The best carpets and rugs are produced at Jaipur, Bīkaner, and Ajmer.

In Bombay and Baroda.

One of the earliest seats of carpet-weaving in India was, according to the reports of old travellers, the ancient city of Cambay. The chief centres in Bombay at the present day are the School of Art in Bombay city, Ahmadābād, and the Yeraoda jail of Poona. Perhaps the most noteworthy object at the Delhi Exhibition of 1903 was a beautiful pearl carpet produced at Baroda. The field is in seed pearls, the arabesque designs in blue and red being worked out in English glass beads, with medallions and rosettes of diamonds, rubies, and emeralds; and the carpet was intended to be held down by four large weights in solid gold thickly set in diamonds.

In Southern India.

The carpets exported from Masulipatam and Cocanāda first attracted attention in Europe as being specially Indian. Sir George Birdwood says that the Masulipatam carpets 'were formerly among the finest produced in India. . . . The English importers insisted on supplying the weavers with cheaper materials, and we now find that these carpets are invariably backed with English twine. The spell of the tradition thus broken, one innovation after another was introduced into the manufacture,' and these carpets cannot now be classed among the better fabrics of India. Masulipatam, Ellore (Kistna District), Wālājāpet (North Arcot), and Ayyampettai (Tanjore) are now the chief centres in Madras. The carpets

produced at Warangal in the Hyderābād State are remarkable for the exceedingly fine count of the stitches, for their harmonious colouring, and for the successful use of silk as a texture. The technical school at Aurangābād produces excellent small rugs, and the jail at Bangalore has for some time past been noted for the good quality of its carpets.

The plain carpets of India, which are usually in cotton but sometimes in wool, are known as *darīs* and *shatranjīs*, *darī* meaning a rug, and *shatranjī* a carpet. They are as a rule transversely striped, and only occasionally show floral or geometrical designs. They are universally used as prayer carpets by the poorer classes of Muhammadans, and often display more art in their manufacture than might be anticipated. Some of the most noteworthy are those from Rangpur in Bengal (blue and white); Agra, Alīgarh, Bareilly, and Bulandshahr, in the United Provinces; Peshāwar, Bahāwalpur, Multān, Gujrāt, and Siālkot, in the Punjab and Frontier Province; Quetta, in Baluchistān; Jaipur and Bīkaner, in Rājputāna; Dhārwār, Belgaum, Ahmadnagar, Kalādgi, and Cambay, in Bombay; and Adoni, in Madras. Cotton carpets, &c.

There are two main forms of production of shawls and *chādars*—the *tili* or *kanikar*, and the *amlikar*. In the former the pattern is elaborated on the loom; in the latter by means of the needle. But except in the case of the most expensive shawls, the needle is also employed to furnish certain portions of the design in the loom-worked articles. Needlework is cheaper than loom-work, and the extent of needlework on a loom shawl may be accepted as a test of inferior workmanship. The great centre of shawl production is Kashmīr, and for centuries past expensive Kashmīr shawls have been much sought after by the princes and nobles of India. The industry was at first confined to this State, but, as the result of famine, colonies of Kashmīr weavers settled in Amritsar, Ludhiāna, Nūrpur, Gurdāspur, Siālkot, and Lahore, about 1833. Shawls were thenceforward produced also at these centres; but owing to the difficulty of obtaining suitable material they were by no means equal to the Kashmīr product. France was for many years the chief foreign market for Kashmīr shawls, but the trade never recovered after the Franco-German War. It was also damaged by the cheap imitations produced at Paisley, and nowadays Kashmīr shawls are sent to Europe and America mainly as curiosities or draperies. Shawls and *chādars*.

The majority of Kashmīr shawls, whether *kanikar* or *amlikar*, are made by a sort of patchwork. They consist

of ribbons woven in the desired pattern, or of strips of *pashmīna* cloth embroidered over the top after having been sewn together to form the shawl. Shawls are mainly of two shapes, the *do-shāla* (or twin-shawl), long narrow shawls always sold in pairs; and the *kasaba* or *chādarrumāl*, which is more or less square. The latter has assumed its present form and qualities largely in consequence of European demand. The Rāmpur *chādar* is a fine quality shawl woven for the most part with woollen warp (*pashm* or *pashmīna*) and a specially prepared silk.

Brocaded woollen piece-goods.

From the most ancient times the nobles of Upper India, more especially the Muhammadans, have worn woollen coats or *chogas*. These are made from richly brocaded cloth, the patterns of which, when not embroidered, are formed by special spools thrust within the warp as the fabric is being woven. This class of goods is known by the name of *jāmawār*. The brocaded pattern may be made with coloured *pashm* or silk or gold. The centres of production are Kashmīr, Siālkot, Jalālpur near Gujrāt, Ludhiāna, Amritsar, and Aurangābād. *Jāmawār* work corresponds closely with the *himru* production of the Deccan mentioned on p. 210.

Trade.

In 1876–7 the exports of raw wool were valued at 107 lakhs, and in 1903–4 at $137\frac{3}{4}$ lakhs. The imports of wool were valued at 5 lakhs in 1876–7, and 14 lakhs in 1896–7, but have since fluctuated, and in 1903–4 stood at 6·6 lakhs. The most remarkable feature of the wool trade is the increase in the imports of manufactured goods, which were valued at 70 lakhs in 1876–7, and at 216 lakhs in 1903–4. These figures do not include European carpets and rugs, which have increased in value from $7\frac{1}{2}$ lakhs in 1876–7 to 26 lakhs in 1903–4. The export of woollen manufactures (other than carpets and shawls) has fallen from 5 lakhs in 1876–7 to 1 lakh in 1903–4. On the other hand, the exports of Indian carpets have been steadily increasing. In 1886–7 the value amounted to $3\frac{1}{2}$ lakhs, but in 1903–4 it had risen to 26 lakhs.

Embroideries.

The term embroideries as used in this chapter includes all forms of needlework, but excludes ornamentation applied on the loom, such as is seen in the manufacture of kincobs, *jāmdānis*, tapestries, carpets, and the like. Embroidery is in its inception a pastoral art. It attains its highest developments in Northern and North-western India, and is more frequently found among the inhabitants of the hills than among those of the plains. Some of the examples met with among the

primitive people of the hill tracts are of a very advanced order and exceedingly beautiful. It may be mentioned as a peculiarity of all Indian needlework that the needle is pulled away from, not drawn toward, the operator. The stitch used materially influences the nature of the designs adopted. For instance, curves are almost impossible with darn or satin stitches, but are easily made by chain-stitch. Similarly, the preference for embroidered garments has largely dictated the method of embroidery to be applied. It is customary, for example, for darn-stitch to be employed on coarse cotton, while chain-stitch is used on silk or woollen fabrics. The former covers the material, the latter ornaments certain portions of it. We may now proceed to a brief account of the principal kinds of artistic embroidery produced in India.

Phūlkari work.

The *phūlkāri* work of the Punjab is an excellent example of darn-stitching. The word *phūlkāri* means 'flowered' work, and might therefore be applied to any embroidery. It is, however, mainly used with reference to the particular kind which is employed as a decoration for the *chādars* of women, and is specially characteristic of the Jāt population of the Punjab. Rohtak may be said to be its home, and the art is also found in its best form in the Districts of Hissār, Gurgaon, and Delhi, and to some extent in Karnāl. *Phūlkāri* work is of three classes—the true *phūlkāri*, where the pattern is diapered at intervals over the cloth; *bāgh* or garden, where the whole surface is ornamented; and *chobes*, where the edges alone are ornamented and the centre left plain. It is much to be regretted that, under the influence of a demand for cheap products, the modern *phūlkāris* exported to England and America have been embroidered in green, red, and purple colours produced by cheap aniline dyes. In *shīshadār* (glass-worked) *phūlkāris* a striking effect is produced by the insertion of small pieces of glass within the design, which are held in position by button-hole stitches. The habit of using mirror glass in embroidery is very widespread in Northern and Western India, being met with in Sind and Kāthiāwār as well as in the Punjab and Frontier Province. In Kāthiāwār it occurs in women's bodices, and in the head-dresses of children.

Darn-stitch embroidery of Kashmīr.

The Kashmīris have attained to a great proficiency in darn-stitching, which is largely applied to the embroidery of shawls and *chādars* (see p. 217); and within the past few years a new and growing industry has been created in Kashmīr, namely, the production of tablecloths, table-centres, and such-like

articles in white cotton or linen, neatly and elaborately embroidered by darn-stitching with bright European washing silks. Such cloths are remarkably cheap and attractive, though usually a good deal over-coloured.

Silk embroideries of Delhi and Agra.

The silk embroideries of Delhi and Agra are perhaps better known in Europe than any other styles of Indian work. They originated very possibly with the luxury of the Mughal court, and were for long applied exclusively to heavy textiles, such as velvet and satin, used mainly for men's coats, caps, or collars. Of recent years an important development has taken place to supply European requirements; and superb curtains, screen-cloths, table-centres, &c., in silk, satin, or velvet, and richly embroidered with coloured silk and a restricted admixture of gold and silver thread, are now produced at both Delhi and Agra. This embroidery is in form satin-stitch. Darn and satin-stitch embroideries of various characters are also to be met with in Baluchistān, Sind, and Kāthiāwār.

Kāthiāwār *choklas*.

In Kāthiāwār the satin-stitch is used in the needlework of the peasant as the chain-stitch is in that of the upper classes, and the embroidered handkerchiefs (*choklas*) of this region are a characteristic form of satin-stitch work. They are made of coarse blue cotton cloth, so completely covered with purple silk that hardly a trace of the original material is visible.

Kasīda work of Dacca.

In Eastern Bengal the *kasīda* embroideries of Dacca, applied to *pagrīs*, handkerchiefs, loin-cloths, and purdahs, deserve notice. These were formerly entirely in darn-stitch, but chain-stitch work has recently been introduced.

Soznīs of Peshāwar.

The Peshāwar *soznīs* or bed-covers, though less known than those of Bokhāra, are much more artistic and are a good specimen of chain-stitch work.

Namdās of Kashmīr.

In Kashmīr chain-stitching is now more prominently associated with embroidered felts (*namdās*) and woollen curtains than with shawls, and within the last few years a considerable trade has arisen in these articles. They are usually in natural coloured wool, or in pale shades of grey, green, blue, or red, and are then embroidered with coloured *pashm* in a bold floral design, which follows the Persian prayer-rug pattern.

Chain-stitch work of Kāthiāwār and Bhūj.

Kāthiāwār is one of the great centres of chain-stitch work; and its embroidered skirts, bodices, handkerchiefs, and curtains are deservedly admired, the colours used being free from the glaring character of the modern Gujarāt work. The most artistic centre, however, of chain-stitch embroidery in India is Bhūj, the capital of Cutch. At Hyderābād (Sind) a large trade is done in embroidered camel-cloths of *sāmbar* leather.

We now come to a form of embroidery on some white washing material, such as calico, muslin, linen, or silk. There are various methods and stitches, but the most frequent is the ordinary satin-stitch combined with a form of button-holing. The great centres of this class of embroidery are Calcutta, Dacca, Lucknow, Peshāwar, Madras, Bhopāl, and Quetta. In Madras silk is the material most generally employed, and the form of needlework thus practised is almost exclusively satin-stitch, though the so-called drawn work with one or two of the special stitches that characterize the *chikan* work of Northern India is to some extent adopted. The beautiful but imperfectly known white embroidery of Baluchistān likewise differs in character from the *chikan* work of Eastern Bengal and Lucknow. It is double satin-stitch, but the patterns are very quaint. The Bhopāl white work is a form of silk-quilting embroidery in satin-stitch, and a similar class of work is met with at Quetta.

Chikan work, &c.

Lucknow is now the most important centre for *chikan* work, though it is probable that the craft originated in Eastern Bengal.[1] The term *chikan* work, which denotes a form of minute satin-stitch, may include piece-goods, but has been usually restricted to special embroideries, such as *chogas*, panels for dresses, cuffs, collars, caps, and handkerchiefs. *Chikan* work in fact takes the place in India that lace holds in Europe. Where gold and silver wires are used, this class of light embroideries is known by the name of *kāmdāni*.

Network of Southern India. Patch-work of Kashmīr. *Kalagas* of Burma.

Network embroidered with silk, or with gold and silk, is characteristic of Hyderābād (Deccan) and Madras. Lace manufacture was introduced by missionaries, and is now a popular industry in Southern India. The artistic patchwork of Kashmīr (a form of *appliqué* embroidery) has already been referred to in connexion with shawls (p. 217). The *kalagas* of Burma, gorgeously coloured cloths with mythological designs, are a special form of *appliqué* embroidery used for wall drapings and coverings for country carts.

Gold and silver wire embroidery.

To the majority of persons Indian embroidery is specially associated with gold and silver wirework. This is of two forms—the heavy and massive (*zardozī*), and the light and graceful (*kāmdāni*). The former is worked on velvet or satin, with (as a rule) a heavy cotton lining to support the gold work, while the latter is on muslin or fine silks. Sir George Birdwood

[1] A peculiarity of the Lucknow work is that yellow or *tasar* silk is largely used in the filling of petals or leaves.

in his *Industrial Arts of India* says:—'The gorgeous gold-embroidered velvets (*makhmal*) of Lucknow, and of Gulbargah, Aurangābād, and Hyderābād in the Deccan, used for canopies of costly state umbrellas of dignity, elephants' cloths, horses' cloths, and state housings and caparisons generally, are largely represented in the Indian Museum. In form they have remained unchanged from the earliest periods of Indian history, but their sumptuous gold scroll ornamentation is in design distinctly of Italian sixteenth-century origin. The Portuguese were in the habit of sending satin to India to be embroidered by natives in European designs.' This form of massive (*zardozī*) embroidery is still well produced at Delhi, Agra, Lucknow, and Benares. The *kāmdāni* work has already been referred to in connexion with *chikan*.

Kincob borders, &c.

Instead of covering a whole fabric with silk, or silk and gold, this ornamentation is in the case of *sāris* and other garments applied only to the end pieces, the body of the garment being of some commoner material such as cotton. These borderings are often erroneously spoken of as 'gold lace'. Trimmings and braids of this description are produced at Gwalior, Surat, Ahmadābād, Aurangābād, and Hyderābād (Deccan).

VII. Drugs (other than Narcotics), Medicines, and Chemicals

Indigenous drugs.

Vendors of drugs or substances presumed to have curative properties are to be found in all Indian villages, while the larger villages and towns possess native doctors who have some empirical skill in the treatment of disease and a certain knowledge of indigenous drugs. About 1,500 substances are held to have medicinal virtues, but very few of these have been examined chemically, investigated physiologically, or determined therapeutically. Of late years the Government of India has appointed a standing committee to examine indigenous drugs, and a selection has been made of about fifty drugs most highly commended by local repute and most frequently met with in the drug shops. These are being investigated and others will then be taken in hand.

Quinine.

One of the most far-reaching measures of modern times for the benefit of the health of the people of India has been Sir George King's system of having quinine, locally produced from cinchona[1], made up in 5-grain (now 7-grain) packets and sold (since 1896–7) for a quarter anna (one farthing) at every post

[1] See chap. i (Agriculture).

office in India. This scheme has proved a commercial success, and has been of immense benefit to the inhabitants of fever-stricken tracts.

Some of the articles returned as drugs in official statistics, such as aloes, asafoetida, and camphor, have been included in Table I; others, such as opium, will be treated under edible substances (narcotics). Of the chemicals the most important articles are bicarbonate of soda, sulphuric acid, alum, and paper-making requisites. Taking the published returns of drugs and chemicals (excluding opium and tobacco) the imports were valued at 31 lakhs in 1876, and at 127 lakhs in 1903–4. The increasing demand for chemicals may be taken as a direct evidence of the progress of India's manufacturing enterprise. The corresponding exports were valued at 44 lakhs in 1876–7, and at 57 lakhs in 1903–4. In both cases these figures include alkalis and minerals which, strictly speaking, should appear in the section devoted to metals and minerals. Indeed, of the exports returned as chemicals, saltpetre is by far the most important single article. Trade in drugs.

VIII. Edible Substances (including Narcotics) and the Industries connected therewith

Essential as this group of products is to the prosperity of India, it possesses no art industries, and is of very minor importance as regards manufactures.

It is almost impossible to form a trustworthy estimate of the total value of the crops that fall under the designation of edible products. Speaking generally, it may be said that food-crops (rice, wheat, barley, millets, pulses, &c.) are raised on about 184,000,000 acres, and all other crops combined on 50,000,000 acres. If the areas under coffee, tea, tobacco, opium, sugar, spices, fruits, cattle-fodder, &c., be transferred to the collective designation of edible products, the total would then be increased to about 198,000,000 acres, the non food-crops (fibres, oils, dyes, &c.) being raised on about 36,000,000 acres. Agricultural interests.

To convey a definite conception of India's food-supply, the produce of this vast area, would be an impossible task. Of necessity no standard of yield could be seriously advanced as applicable to all food-crops; the balance of exports over imports would have to be worked out; the proceeds of garden and orchard cultivation ascertained; wild food-stuffs would have to be borne in mind, and animal food materials, especially fish, taken into account. It would be as unsafe to assume that the

people of India live exclusively on the produce of their own fields, as it would be misleading to suppose that they are entirely vegetarians, or live mainly on rice, as commonly believed in Europe. If any series of grains could be spoken of as the staple Indian food, it would be the millets and pulses collectively, certainly not rice, and still less wheat. But by way of illustration of the total food-supply, it may be assumed that a yield of 12 bushels an acre of all food-grains would be a moderate estimate of the produce. Hence 184,000,000 acres produce, say, 1,175,000,000 cwt. of assorted food-grains. The exports to foreign countries fluctuate considerably from year to year, in direct relation to India's own needs and to the prices ruling in Europe. During the past twenty years it may be said that only in exceptionally bad years have the exports fallen below 35,000,000 cwt., and that only in specially favourable years have they risen much above 65,000,000 cwt. In 1903–4 (an abnormally good year) the exports of food-grains were 77,000,000 cwt., of which 44,000,000 cwt. were rice (33,000,000 cwt. from Burma) and 26,000,000 cwt. wheat (mostly from the Punjab). These exports could, therefore, in no way appreciably affect the total food-supply of India, the more so since they are not drawn from the chief materials of Indian diet, nor from the most necessitous or most densely populated Provinces.

Industrial interests.

The majority of the associated industries of the present series are agricultural or rural in character. Of these may be mentioned opium collection and manufacture; tea and coffee planting and manufacture; tobacco, pepper, and cardamom curing; sugar manufacture; starch and arrowroot preparation; jam, preserved fruit, and sweetmeat making; and grain and flour-milling. The further stages in some of these occupations are, however, often urban: e. g. brewing and distilling, vinegar making, cigar manufacture, perfume making (especially from essential seeds and grasses), sugar refining, and bread and biscuit baking.

Trade.

The main features of the foreign trade will furnish a more accurate conception of these industries collectively than any possible tabulation of the number of works and the probable number of persons employed. In 1876–7 the imports of raw and manufactured food substances were valued at $3\frac{1}{3}$ crores, and in 1903–4 at $11\frac{1}{2}$ crores. The most significant feature of these imports was, doubtless, the transactions in sugar, which in 1876–7 were valued at 40 lakhs, and in 1903–4 at 594 lakhs. The corresponding exports have increased from 26 crores in

1876–7 to 55 crores in 1903–4. The vicissitudes of the five most important articles are worthy of special note. The export traffic in cereals has expanded from 8 to 32½ crores. The sugar export has fallen from about 1 crore to one-tenth that amount. The opium export has decreased from 12 to 10 crores. The tea trade has expanded from 2½ to 8½ crores; and, lastly, the coffee trade has remained stationary for the past twenty-seven years. Table VI (p. 255), which gives an abstract of the foreign trade, indicates the chief industries.

The more important products and industries in sugar, tea, coffee, tobacco, and opium have already been dealt with in chapter i (Agriculture).

Ice and aerated waters.

The advance in the manufacture of ice and of aerated waters has been considerable. In 1891 there were only thirty-one ice factories in India, but by 1900 these had increased to fifty-three, giving employment to nearly 1,000 persons. Only the nine largest are now registered, and they have a capital of 16 lakhs. In 1891 only seventy-six factories produced aerated and mineral waters, but by 1900 the number had increased to 554, giving employment to more than 2,000 persons. There are now few towns or even large villages where it is not possible to procure aerated waters. The extent to which the natives of India use these luxuries, and the cheapness at which they can be obtained as compared with their cost in Europe, are alike remarkable.

Wine and spirits.

That India can and does produce wines is a fact that would appear to have escaped the attention of some writers. The Kashmīr white and red wines were highly commended at the Calcutta International Exhibition of 1884; the former obtained a gold medal in competition with the corresponding wines of France and Australia, being especially commended for its purity and excellence.

Distilling was known and practised in India long before the arrival of Europeans. Recently a few of the owners of breweries and sugar factories have opened distilleries for the production of spirits of wine, rum, and even brandy and whisky. The great bulk of the consumption of wine and European spirits in India is, however, still supplied by importation. The preparation of the 'country spirit' largely consumed by the natives of India is strictly regulated by the state for fiscal purposes and to restrict consumption, and will therefore be dealt with in Vol. IV, chapter viii (Miscellaneous Revenue). In 1903 India possessed in all ten large distilleries, which gave employment to about 378 persons.

Brewing. Brewing was first attempted in India in 1825, but did not become a success until about 1870. It has now developed into one of the largest of the minor industries. In 1903 there were twenty-seven breweries, and their aggregate out-turn was 6,000,000 gallons of beer. About half of this is purchased by the Army Commissariat Department. Fourteen of these breweries are located on the outer ranges of the Himālayas, and produce good light beer better suited to India than some of the imported ales. The imports of beers, &c., usually average from 2,500,000 to 3,500,000 gallons a year.

Milling. The milling of rice has grown into one of the chief industries of Burma. So successfully has this new industry been organized that practically all the rice exported from India is now husked. In 1896 there were 110 rice-husking mills employing 5,700 persons, and in 1903 112 mills employing 16,000 persons. Flour mills—though not so numerous as the rice mills—have been opened at various places, and are now producing a large proportion of the flour required by India. In 1903 thirty-five mills were at work which employed 2,600 persons. In Northern India, especially at Delhi, a still newer industry has arisen in the baking of biscuits specially prepared for the Indian market.

Provisions. As the heading 'provisions' figures largely in trade returns, it may be as well to explain what is usually embraced under that designation. In 1903–4 the provisions imported by India were valued at 203 lakhs. The chief items were dates (36 lakhs); other preserved fruits (24 lakhs); biscuits (18 lakhs); salted fish (15 lakhs); also butter, cheese, *ghī*, bacon and hams, condensed milk, &c. The exports under 'provisions' were valued at 61½ lakhs, the more important articles being *ghī* (23 lakhs), salted fish (13½ lakhs), fish-maws and shark-fins (5 lakhs), and fruits.

IX. *Timber and Woodwork Industries*

Indian timbers. Perhaps no feature of the arts and crafts of India manifests so great a diversity and so many points of interest as woodwork. In India the carpenter's craft very possibly gave birth to that of the stonemason within historical times. As met with in architecture, furniture, and cabinet-work, wood is ornamented in various ways, described below. The art conceptions pursued have been influenced and diversified in each important section of the Empire by the texture of the most abundant and most suitable timbers, and by the religious

sentiments and racial peculiarities of the people. The migration of forms and designs, and the social changes and movements of successive races, can be traced in the wood-carving of different parts of India. The chief woods employed for ornamental work are teak, *shīsham* (black-wood), *deodār* (cedar), sandal-wood, ebony, walnut, satin-wood, *padauk*, *tūn*, *nīm*, Madras red-wood, *anjan*, *dūdhī* (or white-wood), red cedar, *sāl* (*Shorea robusta*), *rohira*, *babūl*, and jack-wood, the order enumerated being approximately that of their importance. Examples of the extent to which art conceptions have been influenced by the grain of the timber employed are afforded by the deep under-cutting that is possible with teak, red-wood, and walnut; the low relief of *shīsham* and *deodār*; the incised designs of ebony; the intricate and minute details of sandal-wood; and the barbaric boldness of *rohira*, *sāl*, *babūl*, and other coarse-grained and hard woods.

Judged by the standard of foreign demand teak is by far the most important timber of India, but several other timbers are of greater value to the people. Mention may, for example, be made of the *babūl*, *kīkar*, *sāl*, *shīsham*, *deodār*, bamboo, and many others as timbers or building materials of very considerable importance locally. Teak is procured mainly from Burma, but is found to a smaller extent in Western, Southern, and Central India. From the forests of these regions it is carried to the coast, and is then conveyed by rail or water to foreign countries and all over India. It is used for the more valuable and expensive articles of house-fitting and furnishing. The other timbers just mentioned have a wider natural distribution and are, moreover, often met with on uncultivated village lands or in the neighbouring jungles and forests: they are in consequence accessible and cheap. Speaking generally, it may be said that distance from markets renders many of the finest Indian forests useless for trade purposes, and has made it economical to import timber from foreign countries. The foreign transactions in Indian timber amount to about a crore of rupees yearly, most of which is due to teak, but they represent a very small proportion of the total trade.

Internal returns show approximately 400,000 tons of timber (in addition to 100,000 tons of teak) as carried by rail and river to meet India's own requirements, but an infinitely larger quantity of timber is used annually, from purely local supplies. A large market for timber has been opened by the growth of India's foreign dealings, e.g. in the supply of tea, coffee, indigo, and opium chests, and of packing-cases generally.

Timber yards and sawmills.

There were in 1903 ninety sawmills, &c., in India, which gave employment to nearly 8,000 persons. Of these, seventy-two mills were in Burma, eleven in Assam, four in Madras, two in Bombay, and one in Bengal.

Trade in wooden manufactured articles.

During the three years ending 1903–4 the export items 'cabinet-ware and furniture' and 'wood, manufactured,' have together averaged about 9 lakhs in value. The imports include various classes of articles which may be viewed as made entirely or partly of wood, viz. 'cabinet-ware and furniture,' 'carriages and carts,' 'sticks and whips' (including fishing-rods), 'tea-chests,' and 'wood manufactured or partly manufactured.' The total value of these was 79·8 lakhs in 1903–4. Other articles shown in the returns also consist to some extent of wood, but have not been included in these figures, such as 'toys and requisites of games' (in 1903–4, 27 lakhs); 'ships, parts of' (27·6 lakhs); and matches (50·6 lakhs). It will thus be observed that India imports articles made entirely or partly of wood to a much greater value than her exports.

Indian arts and crafts connected with wood.

The following classification embraces the more noteworthy crafts connected with wood: carving, as applied to architecture, furniture, or cabinet-work; inlaying with other woods or metals; sandal-wood, carved, engraved, inlaid, or veneered; veneering, *appliqué*, marquetry, and lattice-work (*pinjra*) in woods, metals, porcupine quills, tortoise-shell, &c.; painting, staining, and varnishing; imitation inlaying (with metallic amalgam, &c.); papier mâché and imitation papier mâché, ornaments, toys, models, &c.; and minor woodwork, such as engraved fruits, sola-pith articles, &c.

Wood-carving.

The majority of the people of India regard the possession of a *chārpai* (bedstead) as indispensable, and in some parts of the country low settees (*chaukīs*) or reed-stools (*morhās*) are in demand; but tables, chairs, and sofas are of modern introduction, and are for the most part met with only in the houses of the well-to-do. Persons with any pretentions to social position consider it essential, however, to have a carved door, or perhaps one or two carved windows as prominent features of their houses. In most parts of India the skill of the carpenter has therefore been mainly expended in the production of richly carved doors, windows, or balconies. But to convey a conception of even the leading characteristics of the styles of wood-carving manifested in the various Provinces is impossible. The reader will find full particulars in the interesting series of monographs recently published by the various

Provincial Governments, or in the Official Catalogue of the Indian Art Exhibition of 1903. And it may, in conclusion, be said that the art and industrial schools of Calcutta, Madras, Bombay, and Lahore have given much attention to improving and developing, on indigenous lines, the arts of wood-carving, inlaying, and veneering as applied to furniture, cabinet-making, and architecture, with the result that degeneration has to a large extent been prevented and a superior class of carpenters dispersed over the country.[1]

In Northern India.

In the wide range of wood-carving met with in Northern India, the most powerful influence has undoubtedly been Muhammadan. Sikh art is but a recent adaptation from the Muhammadan, constructed more or less on Hindu lines, while the pure Hindu wood-carving of the present day may be described as a reintroduction. Many towns, however, possess fine doors of Hindu origin which include decorative designs that existed long anterior to the introduction of the Muhammadan style. With all three forms (Muhammadan, Sikh, and Hindu) the doors are, as a rule, studded with metal bosses or are overlaid with brass ornamentations. The actual door, which consists of two leaves, is hung in pivots, not on hinges, and the overlapping portion is lavishly ornamented. In fact, with the poor, this is often the only part of the door that shows any trace of carving. The important centres for ornamental woodwork and furniture are Kashmīr, Peshāwar, Lahore (School of Art), Amritsar, Batāla, Bhera, Chiniot, Gujrāt, Hariāna, Hissār, Hoshiārpur, Jullundur, Ludhiāna, and Udaki.

The essential features of the Muhammadan and Sikh carvings may be said to be their direct adaptation to *deodār*. They are in consequence flat or in low relief, with little undercutting, and are largely constructed on a geometrical basis with elaborately veined and twisted foliage. *Pinjra* (lattice-work built up of minute laths arranged in geometrical forms) is also a leading characteristic of Northern India. Peshāwar has a great reputation for delicate and intricate *pinjra*, and Lahore and Chiniot for bold, massive work.

In the United and Central Provinces.

Woodwork constitutes by no means an unimportant aspect of the architecture of the United Provinces. It is carved, painted, or inlaid; and the timbers mostly employed are *shīsham*, *sāl*, and ebony, with *nīm* and white-wood (*dūdhī*) for furniture and other ornamental purposes. The chief centres are Alīgarh, Bareilly, Nagīna, Budaun, Bulandshahr, Farrukh-

[1] In regard to these schools, see Vol. IV, chap. xiii (Education).

ābād, Ghāzīpur, Lucknow, Mainpurī, Muttra, and Sahāranpur. Nagīna, in Bijnor District, is the centre of a graceful style of ebony-carving. Nāgpur and several other towns in the Central Provinces enjoy a considerable reputation for wood-carving. The work bears a strong resemblance to the Marāthā (or Deccan) style, and thus blends almost imperceptibly into the Chālukyan art which distinguishes the Indo-Aryan from the Dravidian styles.

In Rājputāna, Central India, Sind, Baluchistān, and Bengal.

The deserts and rainless tracts in Rājputāna, Central India, Sind, and Baluchistān afford rich supplies of marbles and sandstones, suitable for house construction; hence the ornamental carving met with is, for the most part, in stone, and such wood-carving as occurs is of a very elementary character. The wood-carving of Bengal is also insignificant. In furniture-making a certain skill has been attained by Bengal carpenters, but exclusively in European designs and mostly through the training imparted in the workshops of European firms.

In Bombay.

The wood-carving of Gujarāt falls under two main types, the Jain style and its Muhammadan adaptation and development. The chief centres are Ahmadābād, Baroda, and Bhaunagar. The wood-carving of Khāndesh and the Deccan is also marked by a Hindu (Chālukyan) and a Muhammadan style. The demand for the once noted lattice black-wood furniture of Bombay city, which is produced mainly by its Portuguese inhabitants, has now greatly diminished.

In Southern India.

The sandal-wood carving of Mysore reproduces the bracketed pillars, and the massive over-door and architrave frames, with their niches and images, found in its Chālukyan temples. The perforated stone windows and fan-lights of these were doubtless the model for the massive form of lattice (*pinjra*) work found in the Deccan and also in Gujarāt. Similarly, the wood-carving of Madras reproduces the characteristic features of Dravidian temples. The chief centres of wood-carving here are Madura, Bellary, and Travancore.

In Burma.

Except for the construction of pagodas, masonry buildings were formerly non-existent in Burma. This circumstance, and the abundant supply of teak, led to a great development of ornamental woodwork. Burma possesses three very distinct styles of wood-carving: namely, the bold massive form seen on the rudder-chairs of boats; the deep and elaborate under-cutting of the screens in pagodas and monasteries; and the simple incised carving of house-doors and window-shutters. The demon worship of Burma has greatly affected its wood-carving

as well as its other arts, the *bīlu* or demon being constantly reproduced. Some of the Burmese figures, whether human or mythological, are excellent specimens of wooden statuary. The chief centres for woodwork are Rangoon, Mandalay, and Moulmein.

In woodwork, as in other art conceptions, Nepāl is more nearly related to Tibet and China than to India. The valley was never conquered by the Muhammadans, and in consequence its arts are unaffected by Indo-Saracenic influences. The chief features of Nepāl woodwork are projecting windows, perforated panels, massive lattice-work, and an exuberance of human, mythological, and animal forms. The older houses and temples of Kātmāndu and other towns show the proficiency that once existed, but for many years past the art industries of Nepāl have been declining in merit and in importance. **In Nepāl.**

The minuteness and intricacy of elaboration of sandal-wood carving are only equalled by the results attained in ivory. The art is applied to small objects only, while its practice is usually confined to a few families. The chief centres of sandal-wood carving are Mysore; Travancore; Trichinopoly, Tirupati, Madura, and Coimbatore in Madras; and Kanara, Surat, Ahmadābād, and Bombay in the Western Presidency. The art is also met with in other localities remote from the regions of production, such as Cuttack, Delhi, Indore, and Alwar. **Sandal-wood carving.**

Woodwork is often inlaid with ivory or bone (see p. 192) or with metals. The chief centres of metal (brass) inlaying are Chiniot and Lahore in the Punjab, and Mainpurī in the United Provinces. Travancore produces some good specimens of copper inlaying. **Inlaying of wood with metals.**

The most striking example of painted wood met with in India is the very peculiar art that has long existed in Sāvantvādi (Bombay Presidency). The woodwork is painted in oils, with red or black as a background. It has borders of brilliant green leaves and pink flowers, and in the centre of the panels mythological groups are boldly portrayed. The supports and feet of a bracket or table are usually finished on the lathe, and display a most delicate and charming touch in lac line colouring. This style of painting and decoration is applied to brackets, tables, caskets, and shrines for the family deity, in which numerous folding doors display the various incarnations of the god. Muzaffargarh, in the Punjab, is famed for its painted bows and arrows, which are often extremely beautiful. Jhānsi turns out boxes, trays, and the like, painted black with **Painted woodwork.**

dull green and red floral designs, but they are not of a very artistic order and the carpentry is poor. Gwalior has a fair amount of wood- and basket-work, and gilded and painted wood and stone form a striking feature of the house decoration of Bīkaner.

Kashmīr papier mâché.

What is known as the papier-mâché work of Kashmīr is at present practically a class of wooden goods with designs painted on a light-coloured ground and coated with a special varnish. Flat goods, such as picture-frames, screens, and the like, are now almost the only articles produced; and even in these the precaution of coating the wood with a thin layer of pulp, or of dressing the surface in the manner followed with papier mâché proper, has practically been abandoned. Kashmīr papier mâché in its true form differs considerably from that of Europe. The paper is never quite reduced to a pulp, but is softened and pasted together, layer upon layer, within a mould. When dried and smoothed down, the pattern is painted in water colours, and glazed by the purest and most transparent varnish procurable. The two chief forms of the old papier-mâché work of Ḳashmīr are the minute rose and the pale-coloured shawl pattern, but both have now practically disappeared.

Pith models and carved fruits.

In Dacca, Rangoon, and Mandalay, *sola*, the material employed in the manufacture of pith sun-hats, is worked up more or less artistically into artificial flowers, and in Trichinopoly into models of temples. Carved coco-nuts and other fruits are produced in Travancore and Mysore, and at the Cannanore central jail.

Turnery.

Turnery, one of the most important of all Indian branches of carpentry, has been already referred to in connexion with lac (section ii, p. 174). The turner is ubiquitous and meets, as a rule, the chief demands of the Indian peasant for ornamental woodwork.

X. *Metals and Minerals, and their Associated Industries*

Metals and minerals of India.

In view of its vast area India is poor in metallic resources; few of the metals and minerals that are met with have been fully exploited; and fewer still are worked on modern systems or with scientific appliances. Ample room, therefore, exists for expansion in the mining and metallic industries of the country. Nevertheless, the purely indigenous or village metal manufactures are perhaps, after those connected with wood, the most important of all the art industries of India. Most of

the household utensils are made of metal, which thus to a large extent takes the place of the porcelain and glass of Europe. The shapes of the domestic vessels in common use have probably been derived from the fruits, shells, horns, and leaves utilized by primitive man, and even to the present day ascetics use the shells of gourds and other fruits, in place of metallic vessels. According to popular opinion copper is regarded as the purest of metals: brass is most frequently employed by Hindus and copper by Muhammadans.

The chief metals and mineral products of India are: coal, gold, iron, salt, and oil. Others, such as precious stones, manganese, mica, saltpetre, borax, tin, lead, copper, soapstone, alum, antimony, asbestos, corundum, gypsum, plumbago, clays, slate, building-stones, and limestone are being developed, and in some few instances have already attained considerable importance, while others have fallen back or have made little or no progress. The economic and practical aspects of the metals and minerals have been dealt with in the preceding chapter (Mines and Minerals), and here attention will be more directly concentrated on the metallic and mineral manufactures and handicrafts. It will suffice for the present purpose, therefore, to state the names of the main groups of metallic materials and manufactures, while discussing the published returns of the foreign transactions in them. In a later paragraph will be reviewed such particulars as are available regarding the number of mines, workshops, and factories, &c., as also of the persons who find employment in connexion with the metallic industries.

The absorption of treasure will be referred to in the following chapter (Commerce and Trade), but it may be stated that in 1876–7 the imports of gold and silver were valued at 11·4 crores and the exports at 4·6 crores; in 1903–4 the corresponding figures were 40 crores and 16 crores.

The next most important item in the traffic in metals includes the imports shown under the name of 'metallic manufactures.' These consist very largely of railway plant and machinery, but hardware and cutlery also form a considerable part. The steady growth of the returns under this heading may, therefore, be accepted as the expression of increasing railway facilities and expanding manufacturing enterprise. In 1876–7 the imports of metallic manufactures of all kinds were valued at about 2½ crores, and in 1903–4 at about 12 crores, while the Indian exports in the last-mentioned year were 4½ lakhs.

The imports under the collective heading of 'mineral chemicals, dyes, and oils' have increased from a value of 19 lakhs in 1876–7 to 4·8 crores in 1903–4. As still further showing India's dependence on foreign countries for metallic supplies, it may next be stated that the imports of 'wrought and unwrought metals' (copper, iron, brass, lead, &c.) were in 1876–7 valued at 3·7 crores and in 1903–4 at 10 crores. Practically, the imports of these metals denote the extent of the Indian copper- and ironsmiths' operations, just as the foreign supply and net power-mill production of yarn available for India may be accepted as the only satisfactory indication of the extent of the hand-loom weaving industry.

No aspect or material of the export trade can be mentioned as in any way comparable with the returns of these imports. The export of manganese ore has recently begun, and for many years there has existed a small traffic in tin from Burma. The growth in the production of coal is one of the most satisfactory indications of the expansion of manufacturing enterprise in the country. The production of petroleum and paraffin has recently assumed a position of vast importance to Burma, and has checked the importation of these minerals from America and Russia. India practically enjoys a monopoly in the supply of certain qualities of mica; but the trade in saltpetre, which was once a highly profitable Indian monopoly, has, through the prosperity of German manufacture, dwindled to a position of secondary importance.

An abstract of the value of the trade in metals and minerals will be found in Table VII (p. 256).

Village industries.

Very little information of a trustworthy nature can be furnished regarding the village industries concerned with metal trades. Every large village has its copper- and ironsmiths and also its jeweller; and in some instances these local industries attain considerable magnitude, such as the manufacture of copper and brass vessels at Srīnagar, Benares, Mirzāpur, Lucknow, Morādābād, Jaipur, Poona, Nāsik, Bijāpur, Madura, Vellore, Mysore, and Rangoon. Similarly, the silversmiths and jewellers of Srīnagar, Multān, Lucknow, Jaipur, Cutch, Ahmadābād, Poona, Bangalore, Madras, Cuttack, Calcutta, Rangoon, and Moulmein are famed all over India. But it is difficult, if not impossible, to estimate the actual number of persons concerned in these industries, and the value of the goods they turn out. The artistic industries will be dealt with in detail later.

Coal.

The first coal-mines under European direction were opened

in Bengal in 1820, but no progress was made till the construction of the East Indian Railway in 1854. Even then advance was slow, until the jute mills of Calcutta had been started. From that date the prosperity of coal-mining has been the direct expression of a rapidly expanding modern commerce. In 1903 there were 302 coal-mines at work, of which 279 were in Bengal. The industry gives employment to 88,500 persons, and the capital of the joint-stock companies has been declared at 240 lakhs. The price of Indian coal delivered in Calcutta now usually ranges from Rs. $2\frac{1}{8}$ to Rs. $4\frac{3}{8}$ per ton. The output of coal was 4,000,000 tons in 1897 and 7,500,000 tons in 1903, of which Bengal produced six-sevenths. The Provinces which come next in order of production are Hyderābād, Assam, Central India, and the Central Provinces.

Gold-mines.

The Indian gold-mines are chiefly in Mysore. Gold is washed from the sands of many Indian rivers, but the total amount thus procured is insignificant.

Petroleum.

The oil-wells of Burma are believed to have been worked for more than 2,000 years. Much of the oil is of a very high quality and can be burned in lamps in its crude state. The wells have recently been worked, and the oil refined, by improved modern appliances. The manufacture of candles from the oil has already been referred to (section iii), and the Burma wells have recently begun to affect the imports of foreign oil and paraffin candles. In few directions has a more far-reaching revolution been accomplished than in the change of Indian demand towards cheap petroleum and other mineral oils, candles, &c., in preference to the vegetable illuminants of former times. This change has been the cause of larger imports, but has at the same time led to a great expansion of the refining and manufacturing industries of Burma and Assam.

Iron.

Iron ores are very widely and abundantly distributed throughout India. Smelting after European methods is, however, carried on only in Bengal, where coal is found in proximity to the ore. Iron and brass foundries are scattered all over the country; but with the exception of the Bengal Iron Company of Barākar, and the railway and engineering workshops and foundries at Calcutta, Bombay, and other large towns, few are of much importance. In 1903 there were seventy-six foundries in India, employing 22,000 persons. The bulk of the iron imports still come from the United Kingdom; but the commoner sorts, such as bars, angle-iron, black-sheet and nails, rivets, washers, &c., are now shipped largely from Belgium,

which also holds the Indian markets for cheap steel, such as steel bars.

Salt. Salt is procured in India from several sources, each supplying large tracts of country. The chief sources are the rock salt of the Mayo Mines in the Punjab and of Kohāt in the Frontier Province; the lake salt of Sāmbhar, Didwāna, and Pachbhadrā in Rājputāna, and Sultānpur in the Punjab; sea salt in Sind, Bombay proper, and Madras; and, lastly, foreign salt imported chiefly by Bengal and Burma. The imports usually range from 331,000 to 514,000 tons, and the Indian production from 771,000 to 1,212,000 tons. The total salt-supply of India amounted in 1903–4 to 1,271,000 tons, of which about 65 per cent. was produced in the country. Nearly half the Indian production is by direct Government agency and the rest under licence. The taxation of salt is one of the most important items of Indian revenue, and the production of this article will be further described in Vol. IV, chapter viii (Miscellaneous Revenue). No statistics are collected of the number of persons who find employment in mining, collecting, refining, and selling salt, but the number must be very considerable.

Saltpetre. It would appear probable that the introduction into India of the art of making saltpetre dates from the discovery of gunpowder. The Indian supply is derived mainly from Bihār, to a much less extent from the United Provinces, and in small quantities from Kashmīr, the Punjab, Central India, Bombay, Madras, and Burma. As obtained from the nitrous soils, saltpetre is an impure article. It is refined at special factories to be met with all over Northern India and in Calcutta. There are about 40,000 factories for crude saltpetre and 600 refineries. The latter deal with about 723,000 cwt. of crude saltpetre and produce nearly 500,000 cwt. of the refined article. Exports from India have not progressed during the past half-century. In 1845 they amounted to 500,000 cwt., valued at 35 lakhs, and in 1903–4 to 392,000 cwt., valued at 41 lakhs.

Borax. Borax or tincal, a native borate of sodium, is found with common salt on the shores of certain lakes in the Punjab, on the Tibetan frontier, and in Tibet itself. It is used extensively as a mordant in dyeing and calico-printing, as a medicine, as a substitute for soap, as a preservative for meat, and as a flux in glass-blowing. It is also invaluable in welding, and is employed by blacksmiths, brass-founders, and electroplaters. For many years the foreign demand for Indian borax has been declining. So recently as 1886–7 the exports were

24,000 cwt., valued at nearly 6 lakhs; the local demand has, however, been little affected by the cheap production of Europe and America.

The supplies of brass and copper are wholly or almost wholly derived from foreign countries, and fluctuate largely with local needs and prices. Copper, being the chief metal used for domestic utensils and easily saleable when necessity arises, is in large demand in times of plenty and is instantly thrown on the market in bad years, so that the rise and fall of this traffic constitutes one of the safest indications by which to judge the economic condition of the people of India. The following import figures may be recorded: 1876–7, 241,000 cwt.; 1897–8, 322,000 cwt.; 1899–1900, 91,000 cwt.; 1900–1, 160,000 cwt.; 1901–2, 194,000 cwt.; and 1903–4, 433,000 cwt. The fall in 1899–1902 was the immediate effect of the scarcity and famine that prevailed in those years. Recently the demands for electric traction and lighting have somewhat increased India's need for copper, but the quantities above given may be accepted as denoting roughly the amount required by the village coppersmiths. Brass and copper.

The antiquity and excellence of the Indian iron handicraft may be judged from the famous iron pillar at the Kutab Minār near Delhi, from the numerous examples of wrought-iron gates of forts and tombs, and from the superb collections of ancient arms. Of late years the Bombay School of Art has turned out some excellent wrought-iron gates and windows, and wrought-iron balustrades are produced in Gujarāt. Burma, too, has attained high proficiency in wrought iron. Near Mandalay there are numerous workshops for the production of iron *htis*, placed like weathercocks on the Burmese pagodas. Artistic industries. Iron and steel.

Throughout India the dealers in art curiosities offer for sale swords, daggers, shields, and helmets in carved steel; and in a few localities, such as Udaipur, Jaipur, and Jodhpur, this art is still practised.

The ornamentation of tinned ware is essentially Muhammadan in origin, as the Musalmāns use copper cooking and eating vessels which have to be tinned before they can be employed with safety. The chief centres of ornamentation of tinned goods and tinned metal are Kashmīr, Peshāwar, and Morādābād (*repoussé* tin). Tinned metal.

The craft of colouring metals with lac is chiefly practised at Morādābād; and the system of ornamentation appears to have been designed to imitate the class of encrusted ware known as *bidri*. It consisted of a background of black lac, on which the Lac-coloured metal.

floral design stood out in white metal. Originally the pattern was bold; but this has gradually given place to a more minute style known as *marori*, and later still to a form, the *charakwān*, in which the pattern is in black or other coloured lac, and the background in brass. Recently a further development has taken place, in which coloured flowers, and even mythological subjects, are inserted within the elaborate *marori* pattern. Within the past few years Jaipur has taken to imitating Morādābād in the production of *marori* and *charakwān* work, with the addition of an abundance of colours in questionable taste.

Enamelling.

Enamelling may be described as the art of colouring and ornamenting the surface of metal by fusing over it various mineral substances. The range of colours attainable on gold is much greater than on silver, and still more so than on copper or brass. This peculiarity is to a certain extent overcome by silvering or gilding the surfaces intended to be enamelled. There are several forms of enamelling, the first being the *cloisonné* of Japan and China, in which wires are fastened or welded to the surface of the metal, in elaboration of the design, much as in some forms of filigree. The various spaces thus outlined are then loaded with the colouring materials, and the article is placed in a furnace, when the wires prevent the various colours from intermingling.

The second form, which is that most prevalent in India, is known as *champlevé*, where the metal is engraved or chased, *repoussé* or blocked out, in such a way as to provide depressions within which the colours can be embedded. A third mode, which prevails for the most part in Kashmīr, is to paint the surface with readily fusible paint, and then subject the article to a moderate heat, sufficient to melt the paint but not to fuse the colours.

The various styles of enamelling in India are so different that they can be readily recognized. Jaipur is pre-eminent for its enamels, though recently the most skilled artificers have migrated to Delhi. The Jaipur enamelling is invariably done in the purest gold, and the plate is so engraved that all but the faintest lines of the metal disappear and the entire surface seems a sheet of translucent enamel. The Jaipur work has, however, deteriorated of late years; and the utilitarian spirit of the times is also marked by the production of a large assortment of sleeve-links, lockets, bracelets, brooches, and the like, and the decoration of the backs of pieces of jewellery, instead of enamelling sword-hilts, plates, &c., as formerly. Bahāwalpur,

and Bhūj in Cutch, are also important centres of gold-enamelling. Multān is famous for its small silver-enamelled ornaments, and the Lucknow and Rāmpur enamels are likewise on silver. In Benares enamel is usually employed to give the ground colour for gold and jewelled ornaments. The copper or brass enamelling of Kashmīr is good of its kind, but coarser than that on silver. The quasi-enamelling of Partābgarh (Rājputāna) and Ratlām (Central India), where the article itself is of glass or thin enamel, set off with a silver rim or gold flower, is also interesting.

Niello may be regarded as a form of enamelling practised on pure silver. The desired pattern is punched and chased, and the hollows are loaded with an amalgam of lead, silver, and copper, which is then fused with silver in a furnace. This art exists in one or two localities in Burma, but appears to be quite unknown to the modern Indian craftsman. Niello.

The gold and silver plate of India could formerly be referred to four or five well-marked types or styles. Within the last few years, however, the silversmiths have taken to producing any or all of the styles, the result being that it has become difficult, if not impossible, to say where the plate may have been made. The characteristic feature of the silver plate of Southern India is *swāmi* work, composed of mythological medallions and canopied niches. The chief centres of production are Bangalore, Mysore, Travancore, Madras city, Trichinopoly, and the Godāvari District. The Bombay Presidency has two well-marked styles of silver plate, the Poona and the Cutch. In the former a bold *repoussé* form prevails; in the latter a graceful and intricate floral design in shallow *repoussé* (probably of Dutch origin) is practised. Bijāpur, Sholāpur, Ahmadābād, and Baroda also provide good examples of Bombay silver work. The Kashmīr styles of silver ornamentation are all forms of intricate and flat *repoussé,* which closely resemble the patterns employed in the copper and papier-mâché wares of the State. Gold and silver plate.

Some years ago there was only one style of silver work in Lucknow, the jungle scene of closely compacted palms. This is still produced, but Lucknow also imitates the style of all other parts of India. Bengal has four great centres of silver-ware—Calcutta, Cuttack, Dacca, and Monghyr. Calcutta produces a form of ornamentation in which rural scenery is depicted on a frosted surface. It is a style now imitated all over India, the characteristic Bengal hut being nearly everywhere shown, though probably quite unfamiliar to the majority of the workers. Cuttack has for many years been famous for

filigree work, which has also attained a footing in other places, among which Trichinopoly, Dacca, Rangoon, and Jhānsi may be mentioned. A large portion of this work is accomplished by children, the sons or pupils of the craftsman. The principal articles made by the Burmese silversmiths are bowls, jars, plates, &c.

Damascened and encrusted wares.

Damascening and encrustation both denote the surface ornamentation of one metal by the application of others. In damascening (*koftgari*) iron or steel is usually ornamented with gold or silver wire. In the various forms of encrusted work the ground metal is rarely steel, and the applied metals are seldom in the form of wire. Encrusted wares fall into two main classes, according as the applied metal is raised above or left below the surface. Tanjore ware is representative of the first class, and *bidri* of the second, though in some forms of *bidri* the applied metal is mainly above the surface, much as in Tanjore ware. The art of damascening appears to have originated with the ornamentation of swords and other weapons, but in modern India it is also applied to the adornment of articles for domestic use. The chief damascening centres are Siālkot, Gujrāt, and Lahore in the Punjab; Jaipur, Alwar, and Sirohi in Rājputāna; Datiā in Central India; Hyderābād and Travancore. *Bidri* ware takes its name from Bīdar in the Hyderābād State. The other chief centres of production are Lucknow, Murshidābād, Purnea, and to a small extent Kashmīr. The encrusted ware of Southern India is of two classes: that of Tanjore, in which the applied portions stand in bold relief; and that of Tirupati, in which the applied metal is levelled with the surface. Brass and copper with silver encrustations are common to both forms, while Trichinopoly brass vessels are encrusted with zinc.

Copper and brass wares.

Indian craftsmen show a large capacity in the utilization of copper and brass and their alloys. In Burma, for example, images of a stupendous size are cast in brass by a small band of operators, whose appliances would seem absolutely inadequate judged by European standards. In many parts of India again, as in Rājputāna, chain bangles are moulded and sold for a few annas a pair, which in Europe and America could not be produced at many times the price charged. Between these extremes in magnitude and intricacy lies the range of domestic and sacred utensils, for the production of which every village possesses its skilled coppersmiths. Ordinary domestic utensils are rarely ornamented, but their shapes are often extremely graceful. The article most generally used by the Hindus is

the *lotā*, a globular melon-shaped vessel, with an elegantly reflexed rim, which doubtless originated from the partially expanded flowers of the sacred lotus. The Muhammadans have given their vessel (*tonti*) a spout, because the Korān ordains that a man should perform his ablutions in running water, and the falling of water through the spout is considered to comply with this direction. The shapes of the *lotā* and *tonti* have given birth to widely different forms of domestic and decorative metal-work. Some of the most beautiful and interesting copper and brass wares of India are those directly required for ceremonial purposes, or which have been derived from the implements used at the temples. The following are the principal centres of ornamental copper- and brass-work: Kashmīr, Nepāl, and Sikkim; Amritsar and Lahore in the Punjab; Lucknow (copper) and Benares (brass) in the United Provinces; Jaipur, Bīkaner, Dholpur, Ujjain, and Indore in Rājputāna and Central India; Poona, Bombay, Nāsik, Bijāpur, Baroda, and Kāthiāwār in the Bombay Presidency; Mysore, Madras, Madura, and Vellore in Southern India. The brass-work of Jaipur, which is especially artistic, takes the form of miniature, and charmingly natural, reproduction of bullocks, carts, and scenes from country life generally. The gongs and images of Burma are also well-known.

Old Indian stone-work may be conveniently classed under three great types, corresponding with the excavation of cave temples and the construction of topes; the building of the Jain, Chālukyan, and subsequent Hindu temples; and the Pathān and Mughal mosques, tombs, and palaces. The eclectic architecture of Akbar was developed by Shāh Jahān into the Indo-Saracenic style, which may be described as a dazzling picture in photographic detail, that subsequently degenerated into the tawdriness and eccentricity of the tombs of Junāgarh. The chief centres of stone-work in India, ancient and modern, are: in Northern India, Peshāwar District (Graeco-Buddhist remains), and the temples of Mārtand in Kashmīr, for ancient work, and the Kutb Minār, with the fort, palace, and city of Delhi, for Muhammadan production; in the United Provinces, Agra, Fatehpur Sīkri, Muttra (Brindāban), Bundelkhand, and Mirzāpur; in Rājputāna and Central India, Chitor, Mount Abu, Sānchī, Dīg, and the Sās Bahu temples and Jain sculptures of Gwalior for ancient monuments; with Udaipur, Bīkaner, Makrāna (in Jodhpur), Jaipur, Alwar, Bharatpur, Dholpur, Jaisalmer, Ajmer, and Gwalior (fort) for modern work in marble or sandstone. In

Stone-carving

the Central Provinces, Chānda and Bhandāra have attained a fairly high reputation for stone-work, and the marble of Jubbulpore is well-known. Bengal has little stone of any kind; and the art of stone-carving is therefore practically unknown except in Bihār, Chotā Nāgpur, and Orissa, where it is found in Mānbhūm, Sasarām, Gayā, Monghyr, Bhubaneswar, and Purī. In Western India good sandstone and rough marble, or rather various forms of limestone, are met with, the best-known carvers and masons being in Rewā Kāntha, Ahmadābād, and Kāthiāwār. The ancient monuments of greatest repute are the cave temples of Elephanta, Kānheri, Nāsik, Kārli, Ajanta, and Ellora; and the mosques, temples, and palaces of Bijāpur, Ahmadābād, Girnār, Pālitāna, and Mūdbidri (South Kanara). Southern India has several centres of modern stone-carving which, however, compare unfavourably with the work of even three or four centuries ago. The best known of the ancient monuments are at Amarāvati, Mahābalipur, and Hampi; with the temples of Madura, Conjeeveram, Tanjore, Rāmeswaram, Perūr (near Coimbatore), Vellore, and Srīrangam. Somnāthpur, Belūr, and Halebīd (in Mysore), and Warangal and Golconda (in Hyderābād), may also be mentioned.

Carving of small articles.

The carving of small articles and models is practised in sandstone at Mirzāpur, Agra, Gwalior, Bharatpur, Jodhpur, Karauli, and Bīkaner; in marble at Jaipur, Jodhpur, and Jubbulpore; and in alabaster and soapstone at Agra.

Lapidary work. Jade.

The green jade stone, worked up at Bhera in the Punjab and a few other localities, has been classed as false jade or rather a very pure form of serpentine. It is softer and more easily worked than the jade which comes from Burma. This 'Indian jade' comes from Afghānistān, as does the stone known to the natives as *sulaimāni* (Purbeck marble), though the latter is also found in the Punjab Salt Range. Cups, *hukka*-bowls, caskets, sword and dagger handles and such-like articles, made of 'Indian' jade or true jade, are often richly jewelled.

Agates.

'The agate vases of Broach and Cambay have been famous under the name of Murrhine vases from the time of Pliny.' The polished and cut pebbles of India have probably been spread over the world to an extent of which few people are conscious. It is said that the pebbles which the tourist or visitor is induced to buy at many well-known seaside and other resorts in Europe, as mementoes of the place, have not only been originally produced but have been cut and polished

in India. A feature of the pebble trade of India, not very generally known, is that the stones are often coloured artificially.

Garnets and rock crystals.

Cut garnets, in the form of necklaces and other small articles of personal adornment, constitute an important section of the lapidary craft of India. The chief centre for the production of these goods is Jaipur. Rock crystals are largely cut in various places, and are made into sword and dagger-handles, or into beads, buckles, necklaces, and the like. These too are extensively produced in Jaipur. The so-called rock-crystal buckles of Kashmīr are made of 'paste diamonds' specially imported for the purpose.

Turquoise.

A large trade is done in the manufacture and sale of turquoise jewellery. The chief traffic is from Kashmīr; and within the past few years a new industry has arisen in that State in the production of picture-frames and other small objects in copper, with a surface layer of fragments of false turquoise compacted by a cement.

Glass-ware.

Some of the glass productions of Patna are artistic, but the majority are imitations of English ware in bad taste and worse execution. The manufacture of glass bangles is a very common village industry.

Inlaid stone-work.

From the nature of the designs employed, Sir George Birdwood has maintained that the inlaid work of the Tāj at Agra and the other great Indo-Saracenic monuments is in all probability an indigenous art. Other writers, however, contend that it was purely Florentine *pietra dura*, introduced into India by Austin de Bordeaux; and in support of this contention it may be noted that many of the flowers so vividly depicted in the Indo-Saracenic tombs and palaces could hardly have been familiar to the stone-workers of Agra and Delhi, though they are carved and inlaid with a life-like accuracy that is remarkable. The glory of the higher art production of Indian stone-work may be said to be this inlaying on marble. The great centre of the craft is Agra, though it is not unknown in other parts of India, e.g. in Bharatpur and Mysore, and the work of Bharatpur is in some respects superior to that of Agra.

Pottery.

The absence from India of a good and abundant kaolin has doubtless greatly retarded the higher developments of the potter's craft, but perhaps less severely than the social and religious customs of the people. According to Hindu observance, pottery is easily defiled and must be broken whenever polluted. The artistic skill of the Hindu potter has, in consequence, been developed in the manufacture of jars in which

to store grain, spices, and pickles, rather than in the production of eating or drinking vessels. With the Muhammadans it may be safely inferred that the glazing of pottery originated with the production of tiles used in the ornamentation of tombs and mosques. In Southern India terra-cotta assumes a greater importance than in the north; and pottery of high quality, and in a style quite unlike that of Northern India, is produced at numerous centres. Potters, whether Hindu or Muhammadan, may be placed under two classes—the *kumhār* or village potter who as a rule produces non-glazed pottery, and the artistic potter or *kūzagar* who turns out coloured glazed ware. With the solitary exception of the pottery of Vellore, all the present-day glazed pottery of India is essentially of Muhammadan origin.

Terra-cotta ware.

Unglazed pottery, or terra-cotta ware, is met with all over India. In some cases it is made so thin that it has been called *kāghazi* (paper pottery); of this nature is the terra-cotta of Gujrānwāla, Bahāwalpur, and Alwar. Sometimes a design is moulded on the surface by the fingers prior to firing; the best example of this is the Alīgarh pottery. Siwān and Khulnā (Bengal), Azamgarh and Chunār (United Provinces), Ratnāgiri (Bombay), Madura (Madras), and Tavoy (Burma) have a reputation for black pottery; but this is frequently of very poor artistic quality. The coating of pottery with coloured lac and other substances is practised in Rājputāna and Southern India. At Lucknow a high standard has recently been attained in the production of artistic terra-cotta statuettes, which recall the well-known Tanagra figures, though they hardly attain the freedom and breadth of treatment of these classic productions.

Painted pottery.

The most-reputed centres for painted pottery are Peshāwar (Frontier Province); Jullundur, Hoshiārpur, Jhajjar, Pind Dādan Khān, Gujrānwāla, Rāwalpindi, Bahāwalpur, and Lahore (Punjab); Amroha, Lucknow, Utraulā, and Sitāpur (United Provinces); Kotah (Rājputāna); and Salem (Madras). The colour is given after the pottery has been fired. This art is intimately connected with the production of idols and other sacred objects, and with the frescoing of the walls of temples and houses, and is quite unconnected with the kindred Muhammadan art of glazing pottery. The black pottery of Pind Dādan Khān, painted in red, is as different from the gilt painted pottery of Peshāwar and the yellow and red ware of Lahore as it is possible to imagine. While the majority of the designs are undoubtedly Hindu in origin, others are closely associated with one or other of the great Muhammadan dynasties;

as for instance at Sasarām in the Shāhābād District of Bengal, where a remarkable form of painted pottery is made quite unconnected with any other Indian style of ornamentation.

Glazed pottery.

The production of glazed pottery may be classed under a few characteristic types. That of Peshāwar resembles majolica, the prevalent form being green and pink on a milky white. The pottery of Delhi and Jaipur is produced from ground felspar mixed with gum or starch, and cannot, in consequence, be formed on the potter's wheel, but has to be moulded by hand. The artistic pottery of Multān, like that of Sind, originated with the production of tiles, and then spread to the production of vases, plaques, and other ornamental wares. The deep blues and whites which were formerly characteristic of the Multān work have, however, now disappeared, and the modern out-turn is extremely poor. The patterns of Sind, which have been imitated in Bombay proper, through the medium of the School of Art, may be classed under two forms: tiles for the decoration of tombs and mosques, and vases for domestic use and ornament. The tiles were nearly always, like those of Multān, on a white field with blue design. Rāmpur and Khurja (United Provinces) manufacture articles in quaint shapes, such as the undulating forms of the pumpkin and the constricted melon. The Vellore pottery is made from a fine white clay which yields readily to the most delicate treatment, and when glazed is either in a clear emerald green or a deep dull brown. The pottery of Burma, and more especially of Pegu, has been famed from ancient times. The most curious forms of this pottery are the quaint urns used for storing the ashes of the *pongyis*.

In 1900 there were eighty-four potteries in India, employing about 2,400 persons. The chief of these are situated at Alīgarh, Rānīganj, Jubbulpore, Ferokh (in Malabar District), Calicut, and Bombay (School of Art Works).

Plaster of Paris and cement work.

Several parts of India are famed for their marble-like cement work, stucco or *chunām*. This is made with lime, mixed with sand and plaster of Paris or powdered marble, and very often with sugar, or some glutinous substance such as the gum from the *bel* fruit or even white of egg; and it assumes a remarkably hard consistence and an exceedingly fine polish. In Bīkaner the walls of houses coated with this surface are beautifully carved just as the stucco is about to set.

Glass mosaics.

Cement or plaster of Paris is also used as the impacting and embedding material for glass mosaic. In some of the more recent of the Indo-Saracenic palaces the ceilings are adorned

in rich geometric designs made of fragments of mirror glass set in cement. This is known as *shīsha* work, and its effect, though brilliant, narrowly escapes the charge of vulgarity. The Burma glass mosaics, cemented with *thitsī*, have already been referred to on p. 175.

XI. *Conclusion*

The Indian Factory Act.

Legislation to regulate labour in factories was first introduced in 1879. Attention had been drawn to the subject by certain remarks in a report on the administration of the Cotton department in Bombay, and a commission appointed by the Bombay Government advised the enactment of a simple law restricting the hours of employment of children and requiring that machinery should be properly fenced. It was at first proposed that Local Governments should have the option of extending the measure to their respective territories, but the Act (XV of 1881) as finally passed was general and compulsory. It was, however, modified in the interests of manufacturers by reducing the minimum age for children to 7, and the maximum to 12 years; Local Governments were empowered to appoint special Inspectors or to make over the work of inspection to District Magistrates. The definition of factory limited the application of the law to premises where not less than 100 persons ordinarily work and where steam, water, or other mechanical power is used; while indigo factories and premises situated on and used solely for the purpose of a tea or coffee plantation were altogether exempted.

In 1890 a commission was appointed to inquire into certain points connected with the subject, and the law was amended in accordance with their recommendations in 1891. The changes then introduced were briefly as follows:—The definition of a factory was extended to include establishments employing 50 hands, instead of 100 as before, and power was given to bring under the Act any establishment employing only 20 hands. The hours of employment for women were limited to 11, with intervals amounting to 1½ hours. The minimum age for children was raised from 7 to 9 years, and the maximum age from 12 to 14; the length of employment per diem in the case of children was reduced from 9 to 7 hours, and their employment at night-time was forbidden. There are other provisions prohibiting Sunday labour, except in industries of a specified nature, prescribing intervals of rest for men as well as for women, and giving Local Governments power to make rules to

regulate water-supply, ventilation, cleanliness, and other sanitary matters. The Act is now about to be amended further, with the object of bringing within its scope factories which work for less than four months during the whole of any one year, and which have hitherto been exempt from the operations of the Act; and of ensuring that the provisions of the law relating to intervals of rest are more generally observed, and that the further precautions which experience has shown to be necessary are taken to guard against injury or death of the operatives by fire or otherwise.

Prior to 1890 the duty of inspection was entrusted to the magistracy in all Provinces except Bombay. In the latter Presidency the appointment of a special Inspector under the Act was made in 1883, but was discontinued in 1887. In 1892 two special Inspectors were appointed, one for the Bombay Presidency and the Central Provinces, and another for Bengal and the United Provinces. These are the only Provinces where special Inspectors have been appointed; elsewhere inspection work is done by District Magistrates, who are *ex-officio* Inspectors, and by subordinate magistrates and other officials appointed by the Local Governments as Inspectors under the Act.

Information regarding the number of factories and the average number of hands employed in them in 1893 and 1903 respectively is given in the table below:—

Province.	Number of factories working and liable to be inspected.		Average Number of Hands employed daily.				
			Men.	Women.	Children.	Total.	
	1893.	1903.	1903.	1903.	1903.	1893.	1903.
Madras	67	81	30,353	2,842	2,007	28,467	35,202
Bombay	267	416	136,995	38,752	7,163	126,145	182,910
Bengal	158	258	168,360	25,813	18,841	139,973	213,014
United Provinces	46	122	33,476	3,649	1,843	20,065	38,968
Punjab	34	188	19,095	2,996	1,037	6,324	23,128
Burma	111	188	31,327	861	157	17,288	32,345
Central Provinces (including Berār)	22*	391	25,905	14,957	1,919	8,355*	42,781
Assam	9	13	1,597	486	138	1,282	2,221
Ajmer-Merwāra	1	2	669	320	17	539	1,006
North-west Frontier Province	..	2	40	24	..	..	64
Total	715	1,661	447,817	90,700	33,122	348,438	571,639

* Excluding Berār, for which figures are not available for 1893.

General statistics regarding occupations.

The following extracts from the Indian Census Report, 1901 (chapter vi), will afford some useful information in regard to the occupations of the people of India:—

'Nearly two-thirds of the total population have returned some form of agriculture as their principal means of subsistence; 52 per cent. are either landlords or tenants, 12 per cent. are field labourers, and about 1 per cent. are growers of special products and persons engaged in estate management, &c. In addition to these, about 2½ per cent., who mentioned some other employment as the chief source of their livelihood, are also partially agriculturists, and another 6 per cent., who have been shown under the head of "general labourers," are doubtless in the main supported by work in the fields. About 15 per cent. of the total population (including dependents) are maintained by the preparation and supply of material substances; and of these more than a third find a livelihood by the provision of food and drink, and a quarter by working and dealing in textile fabrics and dress. Domestic and sanitary services provide employment for very few, and the number of persons who subsist by this means is less than 4 per cent. of the population. The occupations of about 2½ per cent. fall under the head "commerce, transport, and storage," the number engaged in "commerce" being slightly greater than that in "transport and storage." Government service and the "learned and artistic professions" are the principal means of support of 19 and 17 per mille respectively.

'The above proportions refer to the total population; those for cities . . . follow very different lines. In these large centres of population, instead of two-thirds, barely one-twelfth of the population are dependent on agriculture, and the number engaged in the "preparation and supply of material substances" rises from one-sixth to two-fifths; one-eighth derive a livelihood from "commerce," and nearly as many from "personal and domestic services"; one-eleventh from "unskilled labour," and one-fourteenth from Government service. . . .

'We have already seen how, in all cities taken together, agriculture is the means of support of only one-twelfth of the inhabitants, as compared with two-thirds in the general population, but in some of the selected cities the proportion is much lower even than this. In Bombay only one person in 130 is thus supported, in Karāchi one in 40, in Rangoon one in 33, and in Calcutta and Madras one in 28.

'The preparation and supply of material substances, which in India at large support one person in six, in cities afford a

livelihood to two in five. In Delhi, Ahmadābād, and Amritsar more than half the inhabitants are thus engaged; the proportion is above the general average in Bombay, Madras, Rangoon, Karāchi, and Howrah, but in Calcutta, Lahore, and Allahābād and—strange to observe—Cawnpore, it is below it. In Bombay and Ahmadābād the cotton mills support one-seventh of the population. . . . In Rangoon one-ninth of the population find a livelihood in the rice mills. Jute mills and jute presses support one-eleventh of the inhabitants of Howrah, and one-nineteenth are maintained by its machinery and engineering workshops. The leather factories of Cawnpore support nearly 3 per cent. of the population.

'Commerce, including transport and storage, is essentially an urban form of occupation, and is returned in cities by one person in eight compared with one in thirty-eight in India at large; in Calcutta and Rangoon the proportion rises to one in four, and in Bombay, Madras, Delhi, Lahore, Amritsar, and Howrah it is one in six or thereabouts, but in Karāchi it is only one in twelve, in Ahmadābād and Cawnpore one in thirteen, and in Allahābād one in twenty-seven. The variations from the general average for cities in the case of learned and artistic professions (one in seventeen) are not as a rule very marked, but the proportion is unusually low in Allahābād (one in forty) and highest of all in Madras (one in twelve).

'Unskilled labour finds most representatives in Howrah (one in six), Bombay (one in seven), and Agra, Cawnpore, and Allahābād (one in eight). The high proportion in Howrah is due to the entry under this head of 10,000 persons whose means of livelihood was entered merely as "factory work," and who could not therefore be assigned to any definite group; and if these be excluded, only one person in nine depends for his livelihood on "unskilled labour." It is possible that the figures for some of the other cities have been similarly affected by defects in the original return. . . .

'It would be interesting if the table of occupations could be utilized to throw light on the extent to which the introduction of European capital and methods of work has influenced the functional distribution of the people. It is, however, not always possible to draw a distinction between imported, if one may use the expression, and indigenous occupations. The group "Bankers, money-lenders, &c.," for example, includes both the European banker and the village usurer, and "general merchants" include both the wholesale traders of the Presidency towns and the indigenous dealers in general merchandise of

Large industries.

rural areas. The labourers engaged in the construction of railway embankments and canals cannot be distinguished in the returns from those working on roads. The advent of the British has greatly augmented the number of persons employed in the direct administration of the country, and has also added enormously to the staff of teachers, engineers, medical practitioners, and the like; but of these, too, no reliable count can be taken. There are, however, certain occupations which are wholly exotic, of which the principal ones are noted below:—

Occupations.	Persons supported.
Railways (open line)	503,993
Post Office	133,933
Telegraphs	20,490
Tea gardens	874,975
Coffee plantations	106,154
Cinchona plantations	1,007
Indigo factories	15,783
TOTAL	1,656,335

These are shown by the returns to be the means of support of $1\frac{2}{3}$ million persons, or between five and six persons per mille. In most cases, moreover, industries conducted in factories have been distinguished in the course of compilation from the corresponding hand industries. The return is not complete; some factory industries, such as woollen mills, have not been differentiated, while even where they have been, the entries in the schedules were often not sufficiently precise, and factory employés were in consequence relegated to the group provided for hand-workers, or to some more general head, so that the census figures often fall far short of those collected in connexion with the Return of Large Industries published by the Director-General of Statistics. So far as they go, however, these figures show that, in addition to the persons included in the above statement, more than $1\frac{1}{3}$ millions are employed in factories, coal-mines, and other undertakings founded with European capital, or conducted according to European methods. The total thus exceeds 3,000,000, or 1 per cent. of the total population. This may not seem very much, but it is at least a beginning, and there are many indications that India is entering on a period of great industrial activity. The local production of coal, coupled with the extension of railway communications, has removed one of the chief obstacles to progress, and, in Bombay at least,

native capital is beginning to flow more freely towards industrial enterprise. The main difficulty in this connexion is that the ordinary native of this country does not yet put much trust in joint-stock undertakings, and the small capitalist still fights shy of investing his savings in companies.

'Of all the industrial undertakings, properly so called, the cotton mills are by far the most important. According to the Census, 347,728 persons are supported by employment in these mills, of whom 185,875 are actual workers. Half the total number are in the Bombay Presidency, and the rest are distributed over various parts of the country, the largest number in any single Province being in Madras, where it amounts to 17,486. Jute mills are returned as supporting 130,664 persons, practically all in Bengal, and collieries 100,329, more than four-fifths of whom are found in the same Province. . . .

'Next to Class B (Pasture and Agriculture), Class D is numerically the most important in the whole occupation scheme, and includes the means of livelihood of 45,750,000 persons, or 155 per thousand of the total population. It comprises no less than eleven Orders, the largest being "VII—Food, Drink, and Stimulants", and "XII—Textile Fabrics and Dress," as shown below:—

Order.	Persons supported, in thousands.
VII. Food, drink, and stimulants	16,759
VIII. Light, firing, and forage.	1,461
IX. Buildings	1,580
X. Vehicles and vessels	132
XI. Supplementary requirements	1,232
XII. Textile fabrics and dress	11,214
XIII. Metals and precious stones	3,711
XIV. Glass, earthen and stoneware	2,143
XV. Wood, cane, leaves, &c.	3,790
XVI. Drugs, gums, dyes, &c.	456
XVII. Leather, &c.	3,242'

Bibliography

Sir George Watt.—*Indian Art at Delhi* (Calcutta, 1903).

Sir George Watt.—*Dictionary of Economic Products* (Calcutta, 1889-96).

Sir George Watt.—*Memorandum on the Resources of British India* (Calcutta, 1894).

Sir George Birdwood.—*Industrial Arts of India* (1880).

T. N. Mukharji.—*Art Manufactures of India* (Calcutta, 1888).

J. Forbes Watson.—*Textile Manufactures and Costumes of the People of India* (1867).

J. K. Mumford.—*Oriental Rugs* (1901).

B. H. Baden-Powell.—*Hand-book of the Manufactures and Arts of the Punjab* (Lahore, 1868–72).

Journal of Indian Art (London, quarterly).

Indian Textile Journal (Bombay, monthly).

Reviews of the Trade of India, published annually.

Industrial Monographs published by Provincial Governments at their local presses, among which may be mentioned—

Saiyid Muhammad Hadi.—*Dyes and Dyeing of the North-Western Provinces and Oudh* (*United Provinces*).

A. Chatterton.—*Tanning and Working in Leather in the Madras Presidency.*

H. G. Walton.—*Tanning and Working in Leather in the United Provinces.*

E. Thurston.—*Cotton Fabric Industries of the Madras Presidency.*

R. E. Enthoven.—*Cotton Fabrics of the Bombay Presidency.*

C. A. Silberrad.—*Cotton Fabrics of the United Provinces.*

A. Blennerhasset.—*Cotton Fabrics of the Central Provinces.*

J. Samman.—*Cotton Fabrics of Assam.*

N. N. Banerjee.—*Cotton and Woollen Fabrics of Bengal.*

A. Yusuf Ali.—*Silk Fabrics of the United Provinces.*

E. Thurston.—*Woollen Fabric Industry of the Madras Presidency.*

A. W. Pim.—*Woollen Fabrics of the United Provinces.*

D. C. Johnstone.—*Woollen Manufactures of the Punjab.*

E. Holder.—*Brass and Copper Ware of Madras.*

T. N. Mukharji.—*Brass and Copper Ware of Bengal.*

G. R. Dampier.—*Brass and Copper Ware of the North-Western Provinces and Oudh* (*United Provinces*).

D. C. Johnstone.—*Brass and Copper Ware of the Punjab.*

D. C. Johnstone.—*Brass and Copper Ware of the Central Provinces.*

H. J. Tozer.—*Manufactures of India* (Society of Arts Journal, June 2, 1905).

TABLE I. TRADE IN GUMS, RESINS, &c.

	Imports for 1903-4. In lakhs of rupees.	Exports for 1903-4. In lakhs of rupees.
(A) GUMS AND RESINS, &c.		
1. Arabic, Benjamin, olibanum, resin, &c.	18·59	5·43
2. Pitch, tar, dammar	9·53	..
TOTAL	28·12	5·43
(B) INSPISSATED SAPS, &c. (EXCLUDING OPIUM)		
3. Caoutchouc	...	3·47
Manufactured	7·03	...
4. Cutch	0·02	19·72
5. Gambier	6·25	0·02
6. Aloes, asafoetida, camphor	18·05	0·20
TOTAL	31·35	23·41
(C) ANIMAL RESINS.		
7. Lac: Stick	2·25	4·39
Shell	0·01	2,18·31
Button	...	49·36
Other sorts	...	0·33
TOTAL	2·26	2,72·39
8. Wax (excluding candles)	0·37	4·41
GRAND TOTAL	62·10	3,05·64
	Imports.	Exports.
Grand Total for 1876-7	20·82	91·20
" " 1886-7	28·31	1,02·81
" " 1896-7	40·96	1,89·93
" " 1901-2	51·47	1,16·36
" " 1902-3	49·89	2,08·91

TABLE II. TRADE IN OILSEEDS, OILS, AND PERFUMERY

	Imports for 1903-4. In lakhs of rupees.	Exports for 1903-4. In lakhs of rupees.
(A) FIXED OILS, SEEDS, &c.		
1. Vegetable	12·32	15,61·77
2. Animal	14·06	25·52
3. Manufactures	40·28	0·24
TOTAL	66·66	15,87·53
(B) ESSENTIAL AND VOLATILE, &c.		
4. Oils and seeds	3·43	19·41
5. Perfumery	3·13	1·31
TOTAL	6·56	20·72
GRAND TOTAL	73·22	16,08·25
	Imports.	Exports.
Grand Total for 1876-7	25·76	5,83·25
" " 1886-7	58·82	9,80·98
" " 1896-7	79·73	8,90·65
" " 1901-2	94·10	17,91·06
" " 1902-3	77·09	16,28·65

TABLE III. Trade in Dyes and Tans

	Imports for 1903-4. In lakhs of rupees.	Exports for 1903-4. In lakhs of rupees.
1. Vegetable dyes and tans	12·75	1,74·66
2. Animal dyes	1·19	*Nil.*
3. Mineral dyes	82·67	*Nil.*
4. Others not specified	1·60	0·96
GRAND TOTAL	98·21	1,75·62
	Imports.	Exports.
Grand Total for 1876-7	12·66	3,53·11
" " 1886-7	26·13	4,33·56
" " 1896-7	73·13	5,00·97
" " 1901-2	79·05	2,43·85
" " 1902-3	81·06	1,83·02

TABLE IV. Trade in Animal Products

	Imports for 1903-4. In lakhs of rupees.	Exports for 1903-4. In lakhs of rupees.
1. Bristles, brush-fibres, and brush-making	0·9	20·76
2. Coral	4·10	*Nil.*
3. Feathers	0·02	0·5
4. Hides and skins—		
Raw	9·37	5,83·62
Dressed	8·91	3,09·89
Manufactures	26·2 0	2·99
Boots and shoes	27·9 3	6·14
TOTAL	72·41	9,02·64
5. Horn	0·75	12·06
6. Ivory—		
Raw	18·21	0·25
Manufactures	2·36	0·02
TOTAL	20·57	0·27
7. Shells, &c.—		
Shells, all kinds	1·85	1·60
Tortoise-shell	0·36	0·02
TOTAL	2·21	1·62
GRAND TOTAL	1,00·15	9,37·40
	Imports.	Exports.
Grand Total for 1876-7	47·95	3,16·87
" " 1886-7	85·07	5,33·28
" " 1896-7	84·16	7,15·18
" " 1901-2	86·42	8,60·12
" " 1902-3	98·48	8,93·30

TABLE V. Trade in Fibres, Textiles, &c.

	Imports for 1903-4. In lakhs of rupees.	Exports for 1903-4. In lakhs of rupees.
1. Apparel, &c.*	1,71·64	15·85
2. Canes and rattans	3·04	0·27
3. Cordage and rope	5·90	6·18
4. Coir (raw and manufactured)	0·50	50·17
5. Cotton, raw	5·03	24,37·61
Cotton, twist and yarn	2,72·50	8,84·15
Cotton, piece-goods, &c.	28,28·56	1,63·08
6. Flax (raw and manufactured)	19·91	0·18
7. Hemp (raw and manufactured)	5·02	48·56
8. Jute, raw	0·12	11,71·81
Jute, manufactured (all kinds)	11·28	9,46·92
9. Mats and matting	2·69	0·59
10. Paper, all kinds	52·18	*Nil.*
Paper materials	*Nil.*	0·35
11. Silk, raw	59·29	63·42
Silk, manufactured (all kinds)	1,83·35	8·33
12. Umbrellas	24·59	*Nil.*
13. Wool, raw	6·61	1,37·74
Wool, manufactured (all kinds)	2,15·94	27·43
Grand Total	38,68·15	59,62·64
	Imports.	Exports.
Grand Total for 1876-7	21,84·70	18,57·91
,, ,, 1886-7	34,88·77	26,07·28
,, ,, 1896-7	36,39·51	39,08·90
,, ,, 1901-2	40,12·07	48,72·48
,, ,, 1902-3	37,02·35	48,35·11

TABLE VI. Trade in Edible Substances

	Imports for 1903-4. In lakhs of rupees.	Exports for 1903-4. In lakhs of rupees.
1. Coffee	2·36	1,36·74
2. Tea	20·83	8,55·79
3. Tobacco	49·69	20·97
4. Opium	0·04	10,47·02
5. Beverages	1,87·75	0·01
6. Sugars	5,93·58	10·41
7. Spices and condiments	82·20	92·81
8. Fruits and vegetables	9·32	54·27
9. Cereals and pulses	7·00	32,59·28
10. Provisions	2,02·73	61·45
11. Others	0·01	0·26
Grand Total	11,55·51	55,39·01
	Imports.	Exports.
Grand Total for 1876-7	3,31·93	25,84·71
,, ,, 1886-7	6,51·64	37,07·06
,, ,, 1896-7	8,48·38	33,54·31
,, ,, 1901-2	11,42·86	38,18·39
,, ,, 1902-3	10,33·17	44,18·91

* Excluding boots and shoes.

TABLE VII

Trade in Metals and Minerals

	Imports for 1903-4. In lakhs of rupees.	Exports for 1903-4. In lakhs of rupees.
1. Metals (wrought and unwrought, all kinds) .	9,92·53	29·90
2. Metallic manufactures (hardware, machinery, railway plant, &c.)	11,89·06	4·58
3. Minerals (coal, salt, mica, saltpetre, &c.) .	1,02·36	92·87
4. Chemicals, dyes, oils	4,84·34	13·05
5. Stones and building materials, &c. . .	33·90	0·45
6. Earthenware	28·46	0·38
7. Glassware	1,01·17	0·88
8. Pigments and paints	42·79	1·80
9. Precious stones	1,52·15	9·25
10. Jewellery and plate	15·04	2·18
11. Treasure	38,52·61	15,04·39
Grand Total	69,94·41	16,59·73
	Imports.	Exports.
Grand Total for 1876-7	20,22·82	4,62·73
" " 1886-7	25,09·52	3,29·90
" " 1896-7	37,28·31	6,14·51
" " 1901-2	47,83·45	13,01·73
" " 1902-3	58,87·80	11,31·74

Note.—This table includes imports on behalf of Government.

CHAPTER V

COMMERCE AND TRADE

I. History of Foreign Trade

THE first four chapters of this volume, dealing with Agriculture, Forests, Mines and Minerals, and Arts and Manufactures, have incidentally included many details of the foreign trade of India. In the present chapter it is proposed to sum up the leading features.

Early commerce.

The chief trade of India has always been with countries lying to the west. In the earliest times traffic naturally passed by land. It began with the exchange of commodities between neighbouring tribes, and by degrees a regular route was established between the Caspian or Black Sea and the Indus, by way of the Oxus and the Hindu Kush. The difficulties of transport must always have prevented this route from being used for any but valuable articles of small bulk. About the commencement of the seventh century B.C. traffic by sea sprang up between the Persian Gulf and India and even China[1]. From the head of the Gulf caravans followed the great road through Mesopotamia to Syria or Egypt. Rice, sandal-wood, and peacocks were carried by this route from India. Although trade in the Red Sea had been developed at an early period, it was not until the discovery by Hippalus (about A.D. 47) of the possibility of using the regular winds of the monsoons that a third route to India was opened, which gave a considerable impetus to trade. An anonymous writer of the first century A.D. has described the trade in some detail, and from his work we learn that India exported spices, precious stones, and large quantities of muslin and other cotton goods[2]. In return India took gold, silver, brass or copper, tin, lead, coral, and cloth. The value of this trade must have been con-

[1] It has generally been held that the traffic by sea was much older; but see J. Kennedy in *Journal of the Royal Asiatic Society*, 1898, p. 241.

[2] J. W. McCrindle, *Commerce and Navigation of the Erythraean Sea*, 1879.

siderable, for Pliny complains that the annual drain of specie from Europe to India was never less than 55,000,000 sesterces (£458,000).

Mediaeval period.

The northern trade-route, though never of great importance to India, joined the ancient road between Europe and China, and for a time prospered by the closing of the Syrian route during the Crusades. Under the care of Genoese traders it was a source of wealth to the Byzantine emperors till the Turks took Constantinople in 1453. The Syrian caravan trade, which had thriven under the Arabs, was threatened by the Mongols as early as 1258 when Baghdād fell, and ultimately shared the fate of the northern path. The Venetians, who had secured the supremacy of the Mediterranean, yielded before the Turks in 1470, and early in the sixteenth century the conquest of Egypt placed the command of the last route to Europe in the hands of the Turks.

The Portuguese.

Throughout the fifteenth century the Portuguese had been slowly feeling their way down the west coast of Africa, and in 1498 Vasco da Gama landed at Calicut. Along the Malabar coast he found ports or open roadsteads where merchants from Ceylon or Malacca met those from the Persian Gulf or the Red Sea. The Portuguese established their trade at the expense of the Arab merchants by violent measures, and opened factories which were garrisoned by soldiers. A fort at Ormuz commanded the Persian Gulf; the establishment of Goa secured the export trade in pepper and ginger on the Malabar coast; and the conquest of Malacca gave the Portuguese the spice trade with the Farther East. In addition to spices, the exports included gems, drugs, dyes, perfumes, art products, and textiles, which were chiefly paid for in silver, though woollen goods, linen, velvet, hardware, glass, and chemicals were also imported.

The Dutch and English.

The Portuguese allowed naturalized foreigners to take part in the trade with India, the monopoly of which had been secured by a Papal bull, and Antwerp became the great commercial centre of Europe. The failure to discover routes by the north-west or north-east had, however, already inclined other nations to trespass, when the union of Spain and Portugal in 1580 and the ruin of Antwerp brought matters to a crisis between the Catholic and Protestant nations of Europe. An English company trading to the Levant received a charter in 1581, and in 1593 was authorized to trade overland with India. Fifteen Dutch squadrons sailed for India by the Cape between 1595 and 1601. The first English East India Company was

founded in 1600, to counteract the monopoly which the Dutch were already establishing. The early traffic was mainly with the Spice Islands, and it was not till 1608 that Surat was visited, which soon became the head-quarters of the Company's business on the mainland of India.

Seventeenth and eighteenth centuries.

By the beginning of the seventeenth century Portuguese enterprise had degenerated into mere piracy, and was soon driven from the field. For a time there was keen rivalry and warfare between English and Dutch in the Spice Islands. Though ousted from the Archipelago, the English gradually made good their footing in India. Factories were founded on the east coast and in Bengal; and in spite of troubles at home and constant struggles with the Dutch, or with pirates on the Malabar coast and near the mouths of the Ganges, trade increased rapidly.

Just before the first half of the eighteenth century the English had to face the open hostility of the French; and the history of trade is merged in that of territorial acquisition, till in 1813 the trading functions of the Company in India were brought to a close, except so far as the monopoly of trade with China was concerned, and this also ceased in 1833.

Character of early trade.

For many centuries the trade of India hardly developed in nature or in volume beyond its condition in the first century A. D. With the advent of the Portuguese the mainland of India gradually took a larger share in the trade, silks and ivory being added to the exports, with pearls from the Persian Gulf. Still the trade was limited to the products of the coasts and to articles of high value in comparatively small bulk. The classes of merchandise which to-day form the vast majority of Indian exports were only dealt with in strictly local trade, and the regions in which they were produced remained unknown to the enterprising trader and navigator. It was in fact practically impossible to penetrate inland or to draw thence to the coast any of the products of the interior; and even if facilities had existed for local traffic, it would have been impossible in the conditions of navigation which then existed to convey to Europe at a profit the bulky articles of low value which now maintain great fleets of ocean steamers and are the staples of Indian trade. The ports on the west coast were fed only by the narrow fringe of land lying between them and the Ghāts, which formed an insurmountable barrier against commercial operations. On the east coast there was no port on the surf-beaten line of shore until the Gangetic delta was reached at the head of the Bay of Bengal. Hence the dimensions of this

greatly coveted trade were restricted within limits which would now be regarded as insignificant.

Growth of British trade.

The operations of the English Company for some years after the grant of the first charter were equally limited. An annual fleet of five or six ships, the largest of which represented no more than 600 tons, comprised the whole extent of the trade carried on by England, not only with India, but with Ceylon, the Archipelago, and the China seas. The natural obstacles to commercial intercourse, the very imperfect development of communications by sea and by land, the state of incessant war in the country among the rival rulers and states, the struggles for supremacy among the European adventurers, and the costly nature of the articles comprising the trade which limited the demand for them, were all factors tending to keep the trade small. To these causes of restriction we must add the effect of the strict and narrow monopoly established. In spite of these drawbacks trade increased, and in 1675 the Company's exports were valued at £430,000 and the imports at £860,000, besides the private trade. It was said that the Company devoured 'above half the trade of the nation.' The profits were so great that in 1682 the dividend was 150 per cent., and early in the eighteenth century the Company was enlarged. A century later the sales at the India House reached a total of £3,000,000 sterling. In 1813, when the abolition of the Company's monopoly was under consideration, it was stated that the value of the trade was only £2,500,000 sterling. Compared with modern standards the volume was certainly not large; and so late as 1834, the earliest year for which a statistical record exists, the value of the whole trade of India was no more than—

	Rs.
Imports of merchandise	4,26,11,060
Exports ,, ,,	7,99,34,200
Imports of gold and silver	1,89,30,230
Exports ,, ,,	19,47,410
TOTAL	14,34,22,900

Taking the rupee at that time to be equivalent to two shillings, this total represents in sterling £14,342,290.

Changes in trade.

The trade carried on by the Company in the eighteenth and nineteenth centuries was more diversified in its nature than it had been in the days of the Portuguese and their predecessors. Silk, both raw and manufactured, maintained an important place among exported merchandise, as also did spices. Calico and muslin, however, began to decline as

exports, while the introduction of power-looms and spindles in England led to the revolution in the trade which accompanies the competition of steam-power with manual labour. Indian cotton manufactures were gradually displaced by imported goods, for the mills of Lancashire were able to make cloth that was as good for common wear as any made by hand in India, and much cheaper. Indigo came into great prominence as an article of export, followed by sugar in the later days of the Company, when the emancipation of the slaves in the West Indies paralysed for a time the sugar industry there.

Reasons for slow development.

The progress of the trade continued, however, to be comparatively slow, owing to the natural obstructions which remained after the Company had established its rule over much of the Indian continent. During the first half of the nineteenth century roads were non-existent, except where they had been constructed for military purposes; off these great routes all traffic was carried over narrow unmetalled tracks impassable during the monsoon. The rate of movement was restricted by the capacity of the bullocks harnessed to the cart to struggle over such paths, and the day's journey seldom represented more than 10 miles. In many parts of the country even bullock carts were useless, and their place was taken by pack-bullocks, which indeed continue to work in some localities at the present day. Where a navigable river ran through a country it was the main highway of trade carried in boats. Roads and rivers alike were infested by bands of robbers, carrying on the traditional practices which had made highway robbery and murder by armed gangs a lucrative profession in the disorderly days of native misrule. So separated from each other and isolated were even neighbouring districts that the failure of a crop in one district might be followed by famine and death, though harvests were abundant 100 miles away. In 1780–1 the land-revenue demand in Sylhet District was suspended because the harvest was so plentiful that it did not pay to carry grain to market. Moreover, the appliances at the ports for the reception and shipment of merchandise were of the most primitive type. The charge for freight from Calcutta, Madras, or Bombay to London by way of the Cape of Good Hope was high and the duration of the voyage protracted, so that, taking into consideration the charges for internal transit, the existence of trade was almost impossible except for articles for which there was a special demand, in which India possessed a more or less effective monopoly, and which could stand a voyage of many months.

Improvements after 1858.

Though something had been done, especially in the Ganges valley, to develop communications by road, at the outbreak of the Mutiny in 1857 there were only about 270 miles of railway in India, one section being under construction inland from Calcutta and another from Bombay. That event was the parting of the ways, the old order giving way to the new. The suppression of the Mutiny added largely to the Indian debt, and increased taxation was required to meet the charges for interest. It was necessary, if the people were to bear an additional burden, that their resources should be developed. This led to the recognition of the fact that among the reforms projected the extension of communications must hold a prominent place, and the need for them was further emphasized by the military experiences of the two years spent in subduing the mutineers. The construction of railways was therefore pushed on apace. The construction of canals for irrigation was actively undertaken. The accommodation and facilities at the ports were improved. The fiscal system was reformed and simplified, and various other administrative improvements were taken in hand. Every measure adopted, while it gave to the Government a firmer grasp of the position, tended to stimulate the producer to activity and to encourage him to pursue the peaceful ways of trade.

Cost of transit to Europe.

Until the railway system was well advanced it was not possible either to furnish the mass of the people with imported merchandise within their means, or to encourage the agriculturist to grow wheat, oilseeds, or cotton for the oversea market. When these conditions came into existence in the decade 1860–70, the duration of the voyage between India and Europe by the long sea route round the Cape of Good Hope hampered trade in several ways. It kept freights at a height which almost prevented commerce in articles that were also produced in countries nearer to the United Kingdom, limiting traffic to products of which India practically possessed a monopoly; it also gave weevils ample time to damage cargoes of wheat and seeds. This serious difficulty was removed by the opening of the Suez Canal in 1869, the voyage to Bombay by the new route being reduced from a hundred days or more to about twenty-five days in ordinary cases and three weeks when faster vessels were employed. The reduction was of the first importance to Indian trade. To this and to the contemporaneous linking of the ports with the interior in every direction must be ascribed the remarkable development of commerce since 1870, for without these two facilities none of

the other measures of reform which came into operation about the same time could have had any substantial effect. The trading community were thus enabled to supply European manufactures at a cost within the means of the native consumer, and to send Indian products to Europe in good condition and offer them at prices which permitted competition with other countries more favourably situated with reference to the consuming markets, but not possessing the cheap labour of which India still enjoys an abundant supply. The result became manifest during the following decade, 1870–80, in a most striking development of trade.

Fiscal system: Sea customs

This success was aided by certain administrative measures taken by the Government, prominent among which was the reform of the fiscal system. The loss of revenue and increased expenditure due to the outbreak of 1857 compelled the Government to seek increased resources from which to meet the heavy demands upon it. One resource was found in a great enhancement of the customs duties, though it might have been expected that a duty of 20 per cent. in a poor and undeveloped country was likely to have a paralysing effect on trade, by placing articles taxed at such a rate beyond the reach of a considerable body of consumers. The impolicy of such heavy taxation was soon recognized and the rate was reduced to 10 per cent.; this again was found to be excessive, and a further reduction was made to $7\frac{1}{2}$ per cent. In 1875 the general rate was reduced to 5 per cent.; and in 1882 the import duties were swept away entirely except for a few articles of a special character; namely, arms and ammunition, liquors, opium, and salt. But the customs were not confined to imports. Duties had also been levied on the exportation of a considerable number of articles, including food-grains. The duty imposed on wheat had in fact placed a serious restriction on the exportation of the grain even after facilities had been given to the trade by the railways and the Suez Canal, and the Government removed it, on the representations of the mercantile community, in 1873. Following this reform most of the other export duties were repealed step by step, until by 1880 rice was the chief article paying a tax on export [1].

Internal duties.

Along with these duties at the ports there existed a widespread system of internal duties, not only in Native States but even within British territory. A great barrier, known as the inland customs line, was gradually raised across the country

[1] For a fuller account of sea customs, see Vol. IV, chap. viii.

and guarded by an elaborate system of patrolling. It stretched from the Indus in the extreme north-west to near the Bay of Bengal in the south-east; and all trade crossing it was stopped and made the subject of such minute investigation that the bundles of wayfarers were carefully prodded by native subordinates armed with long iron rods, and duty levied[1]. The primary reason for this barrier was the difference in the salt duty levied in different parts of the country. But the barrier was also used to tax sugar exported from Northern India; and the maintenance of this tax, added to the lack of means of transport, led to the importation of sugar from Mauritius into Western India, where sugar-cane cannot be grown extensively at a profit. Other articles besides salt and sugar were also subject to taxation at the customs' hedge, until the Government of Lord Mayo realized the impolicy of the system, and arrangements were made for the imposition of a uniform rate of salt duty throughout India and for the acquisition, by agreement with the Native States, of the working of the salt sources in Rājputāna. Following these arrangements the inland customs' hedge was gradually reduced in length and practically abandoned in 1879. Negotiations were also opened about the same time with the Native States for the abolition of their transit duties; and one by one the States agreed to surrender a privilege which the extension of railways was daily reducing in value, though most of them still levy customs, and a few impose export duties. The benefit resulting to trade was very material; indeed, it may almost be said that trade was made possible where formerly it could not exist. In some Provinces octroi has been levied by municipalities for many years, and care is still needed to prevent this tax from degenerating into a transit duty[2].

Exchange difficulties.

But although natural obstacles were overcome, and improvements were effected in administration, new difficulties arose. In 1873 began that protracted and spasmodic fall in the gold value of silver—the standard currency of India—which for a quarter of a century was the nightmare of Indian financiers. It is unnecessary to revive here the controversy over the merits and defects of a low exchange, a falling exchange, universal bimetallism, particular bimetallism, the gold standard, and the silver standard. So far as commerce with countries under the gold standard was concerned, it was argued on the one hand

[1] For a fuller account of the inland customs' line, see Vol. IV, chap. viii.

[2] See also Vol. IV, chap. ix.

that a low exchange stimulated exports, and consequently aided production, because the lower the gold value of the rupee the larger was the number of rupees into which the gold price of Indian commodities was turned. The argument was capable of being carried to the extreme of absurdity, for if the rupee fell to a shilling the advantage would be greater than if it exchanged for one shilling and sixpence, and still greater if it fell to ninepence, or threepence, or even a penny. While it may be admitted that a falling exchange encouraged the export trade, it also tended to discourage the import trade; and if the latter were thus affected, it was not possible that the former could really be fostered, as exports are merely the form in which the consumer pays for imported goods and must always be equivalent to them. On these lines, however, controversy continued for years with increasing vivacity and acrimony as the fall of silver was accentuated from time to time, a violent decline alternating with relative steadiness in the range of prices, the tendency, however, being always downwards. The truth seems to be that the actual rate of exchange has no particular effect on finance and trade, provided it is steadily maintained when once an adjustment of prices and taxation has been made; but the process of adjustment is tedious, and its continuance most detrimental to the state and the trading community alike. In India the period of transition seemed interminable. The disastrous effects on finance will be described in Volume IV, chapter vi. It became impossible to frame a budget with a reasonable prospect that the results would approximate to the estimates; it became indeed a necessity to revise estimates from time to time during the year, and to scrutinize narrowly expenditure already sanctioned; on the occurrence of a heavy fall in exchange, even useful or reproductive work had to be stopped, the Provincial assignments of revenue reduced, and taxation increased. In 1885 a fall in exchange suddenly occurred exceeding any that had been experienced before, and in the following year new taxation was imposed. For the next decade the Government was obliged to find fresh resources year after year in additional debt, with recurring charges for interest, and in additional taxation. It was the necessity of finding the means to pay the additional taxes imposed that stimulated the export trade rather than the conditions of exchange. For, although the producer obtained a larger number of rupees for his products, the taxpayer, on the other hand, paid a higher price for the imported goods consumed by him and also a larger number of rupees to the

collector of taxes in order to enable the Government to discharge its obligations in England. The facts that increased burdens of taxation were borne, and that trade increased, are to be attributed, not to the merits of a low rate of exchange, but to the disappearance, simultaneously with the fall in silver, of the obstacles to trade already mentioned, and especially to the construction of roads, railways, and the Suez Canal. It may indeed be said without exaggeration that if the fall in silver had occurred before the canal had been opened, and before the railways had linked the plains of Northern India with Calcutta, Bombay, and Karāchi, the administration of India would have been involved in the greatest difficulties. Improved means of communication, by enabling the people to find profitable markets for the products of their fields and their mills, were the salvation of India.

Impossibility of gauging effects of exchange.

The record of trade shows no changes in its volume that can be clearly traced to the fall in exchange, so that no statistics are available to indicate the difficulties and vicissitudes to which trade was subject from time to time, or to estimate what the volume would have been but for the harassing factors introduced by this disturbing element. On the whole, it may be said that, even if trade gained by the fall of exchange, the advantage was counterbalanced by the loss following from the financial readjustments rendered necessary by the same cause, and that the country for many years was deprived of the benefits to be expected from the administrative and economic improvements described above. The existence of a silver standard in China, with a variable and uncertain exchange, still affects trade with that country.

Government relations with trade.

Even when the East India Company was entirely divested of its functions as a trading firm, the jealousy of outsiders, which had led to litigation against 'interlopers' in the seventeenth century, long continued. Up to 1837 Europeans were not allowed to acquire or lease land without the sanction of the Governor-General in Council. For many years commerce was encouraged, if at all, only by such indirect means as experiments in the establishment of new staples of cultivation. Even the alignment of roads, and subsequently of railways, though primarily intended to develop the country, had frequently to be determined by other considerations, especially military needs.

Agricultural Department.

As a result of the inquiry into the famine of 1866, a new Department of the Government of India was formed to deal with matters relating to Agriculture and Commerce. Financial

pressure led to its abolition in 1879, when the consideration of commercial questions was transferred to the Finance Department. Shortly afterwards, in consequence of the recommendations of the Commission which inquired into the famine of 1876–8, a new Department was constituted to deal with Land Revenue and Agriculture only. Between 1875 and 1905 considerable advance was effected in the methods of collecting and publishing statistics relating to production and trade. The complaint was, however, commonly made by those engaged in commerce in India, that Government was indifferent to trade interests, and that commercial questions referred to it were unduly delayed. The manner in which such questions had to be treated inevitably led to their being considered primarily from the standpoint of administrative convenience, and thus far the complaint was perhaps justified.

Commerce and Industry Department.

The first real attempt to bring Government more closely into touch with the interests of trade was a proposal to open a Commercial Bureau. The discussion which followed was valuable, but the increased pressure of work in the Secretariat of the Government of India suggested a more far-reaching measure. In 1905 a Department of Commerce and Industry was formed, and placed in charge of a Member of Council, which has taken over from the Finance Department branches of the public business relating to commercial subjects, and other similar branches hitherto dealt with by the Home, Revenue and Agriculture, and Public Works Departments[1]. In place of the Commercial Bureau at first proposed, a Director-General of Commercial Intelligence has been appointed to the new Department, who will control the preparation of statistics, and will have yet more important functions as an intermediary between the new Member of Council and the mercantile public. By these fundamental reforms questions relating to commercial interests have been concentrated in a single Department of the Government of India, their consideration and speedy settlement have been greatly facilitated, and Government is no longer exposed to the charge of indifference to the interests of an important section of the community.

Chambers of Commerce.

The development of trade has been materially aided by the formation of associations of merchants. Chambers of Commerce have been established at the ports of Calcutta, Bombay, Karāchi, Madras, Rangoon, Cochin, and Cocanāda, and also at Cawnpore and in Kāthiāwār. These bodies superintend the measurement and weighing of goods, prepare

[1] For details see Vol. IV, chap. i, The Government of India.

schedules of rates of commission for various services, and undertake arbitration in commercial disputes, besides supplying their members with information connected with their business. They are consulted by Government on questions relating to commerce, and the more important of them nominate representatives to the Provincial Legislative Councils, and to the Port Trusts in the case of the seaport towns. In some places they are also represented on municipal boards. The majority of the members are European firms, which have the larger share in foreign commerce and also usually in manufacturing enterprises. There are also special associations representing some of the principal industries or trades.

General progress since 1834.

In the foregoing paragraphs the phases of Indian trade have been sketched down to the period when it assumed its present character and dimensions. It will be useful now to give the actual figures of the trade, and to show at a glance how it has increased from the time when a regular record began. These are given below (in lakhs of rupees) for the average trade of quinquennial periods, the first of which extended from 1834-5 to 1838-9, and also for the year 1904-5:

		Imports.	Exports.
Average	1834-5 to 1838-9	7,32	11,32
,,	1839-40 ,, 1843-4	10,45	14,25
,,	1844-5 ,, 1848-9	12,21	16,99
,,	1849-50 ,, 1853-4	15,85	20,02
,,	1854-5 ,, 1858-9	26,85	25,85
,,	1859-60 ,, 1863-4	41,06	43,17
,,	1864-5 ,, 1868-9	49,31	57,66
,,	1869-70 ,, 1873-4	41,30	57,84
,,	1874-5 ,, 1878-9	48,22	63,13
,,	1879-80 ,, 1883-4	61,81	80,41
,,	1884-5 ,, 1888-9	75,13	90,28
,,	1889-90 ,, 1893-4	88,70	108,67
,,	1894-5 ,, 1898-9	88,56	113,93
,,	1899-1900 ,, 1903-4	110,69	136,59
Year	1904-5	143,92	174,14

NOTE.—These figures include Government stores and treasure.

A glance at this table shows the enormous progress which has been made since the period of the Mutiny, the first great advance being in the five years ended in 1858-9. The progress has since continued from period to period, with an occasional pause due to the occurrence of famine. But in recent years even the ravages of drought have been unable to place an appreciable check upon trade, for the extension of the railway system has brought affected areas within the reach of external

markets. The influence of famines upon the foreign trade has been further reduced by the extension of irrigation, which permits the regular production of much heavier crops in the irrigated areas.

With the expansion of trade its nature and character have been materially modified. One ancient feature, however, seems to be permanent. From the earliest times gold and silver have flowed into India in such a perennial stream that the country has been styled a sink for the precious metals. In other countries, more advanced in civilization and with a much more perfect development of commercial relations, it is usually found that the imports of the precious metals do not largely exceed the exports. The excess is limited to the quantity required for the maintenance of the currency, and for use as ornament or in the arts. In India conditions are different. Owing to the habits of the people, to the restrictions imposed by caste regulations, and to the low standard of living, the consumption of imported merchandise is limited, and a larger proportion of the payment for exports is taken in the form of gold and silver. These metals are used for hoarding, either as coin hidden away in secret places, or as ornaments on the persons of women and children. The practice is inherent in races of primitive habits possessing an undeveloped financial system, especially when, as has been the case in India, the past history of the country has warranted the concealment of wealth from the invader and oppressor. In course of time it may be hoped that the customs of India will approximate to those of western peoples; and that the native will invest his profits in a better dwelling, and in food and clothing more abundant and of higher quality. Such a rise in the standard of comfort has already taken place in Burma, and to a smaller extent elsewhere. But for a very long time to come it may be anticipated that the native of India will continue to live as hitherto in a primitive style, akin to what would be called abject penury in more advanced countries, with his little wealth stored away out of sight. So long as these conditions continue, the inflow of the precious metals will be large in itself and greatly in excess of the outflow.

Changes in nature of trade; bullion.

When we turn to the trade in merchandise, however, we find that a complete and radical change has occurred. Silk, spices, indigo, calicoes, and ivory, long the most important items in the export trade, constituting indeed almost the whole of it, have decreased so much in importance that their disappearance from the list of exported merchandise would hardly be apparent

Exports.

in the statistics. More recent additions to the list, once of great relative importance—such as sugar, lac-dye, safflower—have also dwindled into relative insignificance, for reasons which will be mentioned when we come to discuss the course of trade in each of the principal articles. While some articles have thus been relegated to the category of minor trade, other commodities have gradually taken their place. Foremost among these are food-grains (chiefly rice and wheat), raw cotton and cotton yarns, raw jute and its manufactures (bags and cloth for packing), oilseeds, tea, hides and skins (raw and tanned), and opium.

Imports.

In the import trade also, woollen goods, once the staple of the investments of the East India Company, have fallen to a secondary place, while English cottons have increased to such a degree that they now represent between a third and a fourth of the aggregate. Prominent in the list also are cotton yarns, metals (iron, steel, copper), earthenware, machinery and millwork, sugar, and salt.

Excess of exports over imports.

The importation of the precious metals being, as stated above, an unvarying feature of Indian trade, another dominant feature is the annual excess of exports over imports[1]. In the trade of a country which is neither indebted to other countries nor a creditor of other countries, the imports and exports should approximately balance, freights being taken into consideration in making the equation. But no such country exists, every country having payments to, or receipts from, other countries. Where the receipts constantly exceed the payments, that is, where a country is a creditor country, as in the case of the United Kingdom, the imports always exceed the exports, the surplus being received in the shape of merchandise. Where the payments constantly exceed the receipts, that is, where the country is a debtor country, as in the case of India, the exports always exceed the imports.

Method of adjusting foreign payments.

India is largely indebted to the United Kingdom, and remittances in payment for the debt must be made with regularity. The debt consists of interest on the sums borrowed for purposes of state or by some of the railways, the civil and military charges paid in England on account of India, the cost of railway material and other stores supplied, leave allowances and pensions paid in England to officials, civil and military, and the remittances made from their profits or income by British traders and others engaged in business and in pro-

[1] A similar excess is to be noticed in the trade of French possessions in India. The Portuguese settlements have very little trade direct with foreign countries.

fessional pursuits in India, and by British officials. These payments for debt and remittances are in the main covered by bills (or telegraphic transfers) drawn by the Secretary of State in Council on the Indian treasury, which average at present about £24,000,000 sterling a year[1]. The bills are bought in London by the banks which finance the Indian trade, payment being made to the Secretary of State in gold, and the bills are cashed in India in rupees from the Government treasuries, the proceeds being distributed throughout the country in payment for produce destined for export. A considerable proportion returns in due course to the treasury in payment of land revenue and other claims on the taxpayer. On a few occasions it has happened that at a critical juncture, a famine, a war, or once after the closure of the mints when trade was temporarily dislocated as a consequence of that measure, Government has been obliged to reduce the amount of the drawings, which have then represented but a small proportion of the excess of exports, the difference being met by an addition to the debt.

Among factors of great importance affecting Indian trade a prominent place must be given to freights. The exports not only exceed the imports in value, but they also consist chiefly of raw material, and are thus bulkier than the manufactured articles received. Freights from India to Europe must therefore be sufficiently high to cover losses incurred by the absence of full cargoes for the return voyage, and exceedingly high rates are charged on articles which cannot be shipped in bulk. Though these conditions may disappear with the development of Indian industries, they form a considerable handicap to them at present. Influence of freights on trade.

II. The Ports of India

The geographical position of India is apparently favourable for international trade. Projecting as a great peninsula into the Indian Ocean, a long coast-line is presented to the navigator facing west and another equally long facing east, Burma again presenting a third long coast-line opposite the eastern coast of India.

But vast as is the littoral of the Indian peninsula, it is singularly lacking in harbours offering accommodation for the large vessels now employed in the international carrying trade. On the west coast, from Baluchistān to Cape Comorin, Paucity of harbours.

[1] See also Vol. IV, chap. vi.

navigation practically ceases during the monsoon months, when the rocky shores are furiously beaten by wind and waves. At only a few ports on that coast is an intermittent foreign trade carried on, mainly with Ceylon; and the great bulk of the foreign trade is concentrated at Bombay and Karāchi, these being the principal channels for the trade of North-western and Western India. On the east coast of India the absence of harbours is even more striking, for south of the Gangetic delta there is nothing better than an open roadstead unapproachable within miles by any steamer drawing more than 15 or 20 feet. An endeavour has been made, by the construction of sea-walls, to convert the Madras roadstead into a port, but with only moderate success.

The Burmese coast of the Bay of Bengal is much better supplied with ports, Moulmein, Rangoon, Bassein, Akyab, and Chittagong having good harbours accessible by steamers of large draught. But the foreign trade has here been largely concentrated at Rangoon, that port possessing inland communications by the Irrawaddy and now still farther by railway; while Moulmein, Bassein, and Akyab have been restricted to the trade of the surrounding districts, being cut off from the distant interior. Chittagong was similarly isolated until quite recently, when the railway linked it with Assam.

Chief ports.

As the result of these physical conditions, practically the whole of the foreign trade of India is concentrated in the ports of Calcutta, Bombay, Rangoon, Madras, and Karāchi, naming them in the order of their importance. The first four are the seats of Provincial Governments; in them the banks and some of the railways have their head-quarters, and most of the European mercantile community is gathered; while Calcutta, Bombay, and Rangoon are also great centres of industrial activity. The relative proportions of trade according to its geographical distribution on the Indian coasts are shown below:—

Trade in Merchandise.

	Decennial Average.	Imports (lakhs of rupees).	Exports (lakhs of rupees).
Bengal	1882-3 to 1891-2	23,38	36,36
	1892-3 „ 1901-2	28,70	47,36
Bombay	1882-3 „ 1891-2	23,89	35,34
	1892-3 „ 1901-2	26,94	34,22
Madras	1882-3 „ 1891-2	5,29	9,55
	1892-3 „ 1901-2	6,11	11,81
Burma	1882-3 „ 1891-2	4,55	7,25
	1892-3 „ 1901-2	5,26	9,76
Sind	1882-3 „ 1891-2	2,64	4,10
	1892-3 „ 1901-2	4,42	5,95

Treasure has been omitted from these figures, as it has little relation to the general trade conditions of a port. But it may be stated that practically all the imports and exports of gold and silver are centred in Bombay.

Port Trusts. The management of the six chief ports of India—Calcutta, Bombay, Rangoon, Karāchi, Madras, and Chittagong—is entrusted to Port Commissioners, under the supervision of Government. Port dues are fixed by Provincial Governments, subject to the maximum rates laid down by the Indian Ports Act of 1889. Fees for pilotage and other services are also charged at various rates, and special Acts have been passed for the principal ports. The constitution of Port Trusts has been a valuable feature in the development of facilities for trade, and large works have been carried out by these bodies for the improvement of the harbours.

Calcutta. Until the opening of the Suez Canal, and the linking of the interior by rail with Bombay and Karāchi, the trade of India with foreign countries was largely conducted from Calcutta. The military situation created by the Mutiny of 1857 demanded the completion of a great railway system from the sea to the north-west, and by 1864 the East Indian Railway was open for traffic throughout from Calcutta to Delhi.[1] The line is laid through the most productive tracts of Northern India and follows in the main the course of the Ganges, which was formerly the easiest highway of commerce, and the Grand Trunk Road.

Bombay. The development of communications with Bombay, though it commenced earlier than in Eastern India, was not completed till a later date, owing to the difficulties of the approaches to the island from the interior. Commerce was also hampered by the absence of docks, which prevented trade during the monsoon months. The cotton famine, however, caused by the American Civil War (1861–4) gave an enormous impetus to the trade and prosperity of the city. This was followed by the most severe commercial crisis recorded in the history of India, but recovery was rapid. It was aided by the completion of the railway to Jubbulpore and Nāgpur, the extension of the Bombay, Baroda, and Central India Railway to Delhi and Agra, and the opening of the Suez Canal in 1869, while the construction of the docks has enabled export business to be carried on all the year round without interruption by the elements.

1 Except bridges over the Jumna at Allahābād (opened in 1865) and Delhi (1867).

Karāchi.

Karāchi is merely an importing and exporting centre, having little opportunity for industrial development. Until a recent period its foreign trade was very small, most of the imports being received from Bombay and most of the exports sent to that place for transhipment abroad. But the construction of a safe and commodious harbour and the extension of the railway from the rich plains of the Punjab to Karāchi have altered its position, and to-day there is a very substantial foreign trade, chiefly in the export of wheat, oilseeds, and wool. But the trade is subject to violent fluctuations, depending on the nature of the harvests in the Punjab, which is its chief source of supply.

To the completion of the Suez Canal, the Indian trunk railways, the Bombay docks, and the Karāchi harbour works, are due the great development given to the trade of Western India in the period following 1870, a development which gradually brought Bombay up to the level of Calcutta as a commercial centre.

Further development of Calcutta.

Meanwhile the extension of the railway system in North-eastern India added year by year to the sphere of influence of Calcutta as a seaport and distributing centre. To meet the requirements of the increasing trade thus concentrated in Calcutta, it became necessary, as in Bombay, to improve the conditions of the port. Formerly all ocean-going vessels were moored in the stream and loaded and discharged their cargo by lighters; but this primitive system has been in great part superseded by the construction of jetties and wharves along the Calcutta foreshore of the river, and later by the construction of docks at Kidderpore to which railway waggons now bring merchandise alongside the steamers. At the same time the service of steamers on the river highways between Calcutta and Assam has been greatly improved and developed, to meet the necessities of the tea estates, which increased their yield with great rapidity. The reduction of freights between Calcutta and Burma has also stimulated the trade of the city with that Province. Still greater became its importance with the rise of industrial enterprise. The exportation of jute in its unmanufactured condition began, on a noticeable scale, about the time of the Crimean War, and gradually increased until it is now the most important of the staples of Calcutta trade. But while the raw material was being shipped in yearly increasing quantities for manufacture at Dundee and elsewhere, the bags and sacks and cloth required for packing merchandise exported from Calcutta were still laboriously woven by hand

from the raw material. With the possibility of utilizing the coal of Bengal came the opportunity for establishing the local manufacture of jute, and the banks of the Hooghly were gradually disfigured by the unpicturesque mills which offend the eye along the course of the river above and below Calcutta. Their construction indicated a great advance in the process of economic evolution in Bengal. To-day Calcutta supplies all India with jute cloth and bags, and also exports enormous quantities of those articles to North and South America, to Australia, Africa, and many other countries. The time is perhaps not far distant when, as regards these coarser products of jute, Calcutta may possess the monopoly of the world's markets. The finer products, carpets and so forth, have not yet been produced by the Calcutta mills, as they are fully employed in meeting the much larger demand for packing material. If it may be said that Bombay is built upon cotton, it is no less true that Calcutta is built upon jute.

Rangoon.

The rise of Rangoon is of relatively recent date. For many years after its acquisition by the British as a result of the war with Burma in 1852, the port was merely a place for the exportation of rice grown in the vicinity and, in a subsidiary degree, of teak-timber. Then followed the erection of mills for husking and cleaning rice, and later the petroleum refining industry has added to the importance of Rangoon. The extension of the railway northward has brought it into touch with ever-widening markets, and to-day it is the chief port of the Province, with a trade that expands as cultivation increases.

Madras.

Madras is not well situated for trade, and the costly efforts made to provide a harbour on its exposed shore have been attended with indifferent success. The place is therefore not much favoured by shipping. The construction of railways too, which in other provinces concentrated the import and export trade, has here tended to the contrary result, much trade being dealt with at the southern and western ports of the Presidency, leaving to Madras little more than a local traffic. Here also, however, industrial development, represented by the establishment of a few cotton mills, has saved Madras from the depression which would probably have overtaken it, and on the whole trade has increased, though slowly.

Shipping.

Before the opening of the Suez Canal foreign trade with India was carried almost exclusively in sailing vessels. Since that event the importance of steamers has increased continuously, as shown by the following figures which relate to

vessels engaged in foreign trade entered and cleared at ports in British India, for three decennial periods :—

	Sailing.		Steam.		Total.	
	Vessels.	Tonnage.	Vessels.	Tonnage.	Vessels.	Tonnage.
1884-5	7,354	2,317,589	2,984	4,332,181	10,338	6,649,770
1894-5	6,205	1,443,333	4,372	6,812,489	10,577	8,255,822
1904-5	3,412	352,989	6,386	13,528,347	9,798	13,881,336

While the number of sailing ships trading with India has decreased rapidly, their size also has diminished. A few ocean-going vessels still visit Calcutta, but the sailing ships entering other ports are now almost entirely native craft, engaged in trade with East Africa, Arabia, Persia, and Southern Asia. In 1904-5 the tonnage of steamships was 97·5 per cent. of the total. About 84 per cent. of the trade of India is carried under the British flag, and 61 per cent. of the tonnage is included in entries from and clearances to the United Kingdom and British possessions. Vessels belonging to foreign countries are, however, obtaining an increasing proportion of the carrying trade; Germany has the largest share, followed by Austria, France, and Norway.

III. *Description of Modern Trade*

Increased trade in merchandise.

The increase in the imports and exports of merchandise[1] in the last decade, compared with the preceding period, is very conspicuous :

		Imports (in lakhs of rupees).	Exports (in lakhs of rupees).
Average	1882-3 to 1891-2	59,75	92,60
,,	1892-3 to 1901-2	71,40	109,10
Year	1902-3	78,79	128,82
,,	1903-4	84,82	152,96
,,	1904-5	96,68	157,50

Note.—The figures for each year will be found in Table I at the end of this chapter.

The increase in the second decade over the first was 19·5 per cent. for imports and 17·8 per cent. for exports. It is indeed almost surprising that there should not have been a decline instead of an increase, for the first decade was

[1] Excluding treasure and Government stores.

practically free from any of the seasonal vicissitudes which from time to time cause violent fluctuations in Indian trade. The second decade, on the other hand, comprised a series of years of widespread failure of the monsoon, causing great distress over extensive regions, and culminating in the most intense series of famines known in India for a century. Trade and industry were further disturbed by the appearance of the bubonic plague in 1896, which caused panic and led to the hasty flight of work-people from every industrial establishment in Bombay, paralysing for some time the cotton manufacturing industry, and still exercising a deplorable effect on trade and industry generally.

But every new line of railway laid in India brings new fields of production into direct relations with the market, and even severe drought is not followed by the overwhelming disasters experienced forty years ago. Trade is contracted by the failure of much of the harvest, and with the exports the imports also shrink in dimensions, but not in any very remarkable degree, while the recovery in the following year, if the rainfall has been adequate, is most remarkable. Thus, in 1900–1, a very bad year, the exports amounted to 107 crores; in 1901–2, a good year, they increased to 124 crores; and by 1904–5 they had risen to 157½ crores.

Imports.

The imports and exports of merchandise may now be discussed separately. The former[1] represented in 1904–5 a value of more than 96½ crores, or £64,000,000 sterling. This is a large sum, but in proportion to the population it is small, not amounting to more than Rs. 3-7-0 (4*s.* 7*d.*) per head.

Nature of imports.

The list of imports is very large; but a single item, cotton goods and yarn, represents a value of 38·05 crores, or 39 per cent. of the total. Ten more items form an equal proportion together; these are, in the order of their value—

	Crores of rupees.
Metals (mainly iron, steel, and copper)	11·74
Sugar	6·90
Machinery and millwork	4·03
Mineral oil	3·28
Woollen goods	3·08
Apparel	2·24
Provisions	2·17
Silk manufactures	2·12
Chemicals, drugs, tobacco, &c.	1·88
Liquors	1·87

The other items in the list, constituting a fifth of the total

[1] The value of articles imported by Government is excluded.

imports, are still smaller in value, glass and dyeing materials being the most important. Further details of some of the minor imports have been given in the preceding chapter.

Small demand for foreign goods.

The market in India for foreign goods is extremely limited, and a substantial proportion of the imports mentioned above is dependent upon the needs and demands of the growing European community. It should also be noted, in explanation of the small value of imports of railway material (1·41 crores), that most of the Indian lines are now the property of the state, and the imports of material for them are registered as Government imports, while the value stated above refers only to imports for the few lines which are not managed by the state. Table II shows the value of imports on behalf of Government in 1904–5.

Importance of cotton goods.

The most prominent feature of the import trade is the large demand for cotton manufactures. The imports of yarns are of comparatively small importance, and the trade is declining. Grey (unbleached) yarns of the lower counts are no longer able to sustain the active and increasing competition of the Indian mills, and the trade is being gradually diverted to the supply of coloured yarns of medium counts [1]. Even in respect of these the energy of the Indian mills is making itself felt, and the practical extinction of the trade in yarns is only prevented by the fact that for the higher counts imported cotton is required, no Indian cotton having a sufficiently long staple for their production. The Indian mills cannot as yet obtain or spin the finer cottons in such advantageous conditions as prevail in Lancashire.

Piece-goods.

The bulk of the import trade in cotton manufactures is represented by piece-goods, divided into three classes: namely, (*a*) grey or unbleached, (*b*) white or bleached, (*c*) coloured, printed, or dyed. Unbleached goods usually form about 60 per cent. of the total. In 1904–5 the quantities imported were—

Grey (unbleached)	1,210,000,000 yards.
White (bleached)	584,000,000 ,,
Coloured, printed, or dyed	494,000,000 ,,

A total of about 2,288,000,000 yards among a population of nearly 300,000,000 allows between seven and eight yards for each person. This average needs reduction, however, for the quantity transported to countries bordering the Indian frontier, but the statistics are too imperfect to permit of an estimate

[1] The description by 'counts' denotes the number of hanks of 840 yards which make up a pound avoirdupois.

of that quantity. On the other hand, the imports are supplemented by the large and increasing quantities woven in the Indian mills, especially from unbleached yarn made of the lower and medium counts, not to mention the still larger quantities woven in hand-looms.

The expansion of the Indian spinning and weaving industry has in fact brought about a great change in the nature and type of the cotton manufactures exported from Lancashire. Formerly a very large proportion of the exports of Indian raw cotton went to Lancashire, whence it returned in a manufactured state. As mill after mill was opened in India, however, the demand for Indian cotton gradually fell away until the imports of such cotton into the United Kingdom have shrunk to the smallest dimensions. The Lancashire weavers substituted American and other cotton for Indian, and set themselves to provide cotton goods of the higher classes for the Indian market. That is the present position, but there are indications that the Indian mills are making these also with increasing success. So far as unbleached goods are concerned, there does not appear to be any substantial rise in the supply of recent years; and having regard to the increase of population the trade may be said to be slowly declining, the reason for the decline being partly that local goods are competing and partly that the demand appears to be turning in the direction of the other classes. Effects of Indian mills.

It is not necessary to discuss the fluctuations in the other items of the import trade; but reference must be made to the striking advance in the consumption of imported sugar and petroleum, two articles which are largely produced in India itself. The case of sugar is further discussed below in connexion with the export trade. The exploitation of Indian oil-fields on a large scale and in a systematic manner is a recent development, and it is as yet uncertain whether the local supply is sufficiently large and continuous to supersede importation. The prospects so far are, however, distinctly encouraging. Sugar and petroleum.

Examining the long and varied list of articles which are imported into India, the reflection naturally suggests itself that many articles are included that might be made in the country. It is frequently said indeed that India can manufacture almost anything that is required for local consumption; that therefore it is reasonable to anticipate a speedy development of national industry on a large scale; and that British capitalists should help in realizing the anticipation. It is quite true that India Possibility of developing Indian manufactures.

can manufacture many of the things required for consumption in the country. The question then arises whether the articles to be manufactured can be turned out with such cheapness as to permit of successful competition with similar imported goods produced by capitalist manufacturers in Europe, under conditions combining the highest degree of skill, efficiency, and economy, and whether a local market can be secured large enough to encourage the investment of capital in a new enterprise.

Effects of a small market.

These two considerations run together, the first being dependent to a large degree upon the second. The imports include many articles which cannot be produced under conditions allowing of successful competition with imported articles; but there are also others which certainly might be so produced. Then follows the question whether there is a sufficiently large demand for the latter to permit of their manufacture on such a scale as to secure the greatest economy and efficiency. To this question there is in most cases but one answer: there is no such large demand. A manufacturer in Europe who sends his goods to India sends them also to many other countries, and he has besides the local demand of a country in the most advanced stage of industrial civilization. In many cases his trade with India is not even a large proportion of his total business; and if he lost it, he would not lose any portion of his capital. The manufacturer setting up an establishment in India finds himself in a different position. He is confined to the Indian market and the still more limited demand of the neighbouring countries, for he cannot export his goods to other manufacturing countries in face of the competition of goods made on the spot. A serious risk is involved in opening a new industry under such conditions, for the loss of the local market from any cause, or the reduction of the demand through the competition of importers determined not to lose their position, would involve not merely loss of profit but the loss of capital. Such considerations have no doubt prevented capitalists from embarking on uncertain enterprises in India. There are, however, some industries which India can certainly pursue with success, the materials being cheap and abundant and the demand extensive. It is the aim of Government to collect and publish information bearing on such subjects.

Transit trade.

The transit trade of India is no longer large. Bombay was formerly a dépôt whence European and other foreign goods were reshipped to the Persian Gulf and the east coast of Africa; but the trade was never important, and in recent years it has

declined owing to the growth of direct trade between Europe and those regions. For the same reason the reshipment of foreign goods from Burma and Madras to the Straits has fallen off, and there seems but small prospect of the recovery of the trade. In 1904–5 the total value of the transit trade represented only 3·37 crores [1].

Exports. Indian merchandise.

Table I (p. 307), which gives the yearly value of the exports of merchandise of Indian origin, is of interest as showing the dimensions and the great expansion of the trade in the last twenty years, and also the violent fluctuations to which it is subjected by the vicissitudes of the seasons. By far the largest part of the exports consists of food-grains; raw materials for manufacture, such as oilseeds, cotton, jute, hides and skins; and opium, tea, coffee, wool, silk, and various other articles, the production of which is more or less dependent on the season. In a year of deficient rainfall the supply of wheat, cotton, oilseeds, the most important among these staples, is materially reduced, prices running up with great rapidity, and foreign trade for the time being falls into a state of suspended animation, though a season of drought now imparts great activity to internal commerce. Hides and skins are an exception to this rule, for the mortality among cattle in a time of drought fills the market with these articles.

Manufactured goods.

Among the comparatively few manufactured goods exported from India, the total representing only 20 per cent. of the whole export trade, two stand out in marked predominance, namely, manufactures of cotton and of jute. Indeed, apart from these the exports of Indian manufactures are of quite trifling dimensions, nor are the articles of such a nature that any particular expansion may be anticipated. The two mentioned, however, are of considerable and growing importance as industries, their importance being far greater than is indicated by the returns of foreign trade, for these goods have a large and increasing local sale in addition to their supply to foreign markets. The cultivation of jute is practically limited to Eastern Bengal and Assam; and the manufacture of the fibre is restricted to the mills which line the shores of the Hooghly near Calcutta.

Cotton.

While jute is thus a monopoly of Bengal, the manufacture of cotton is most important in the Presidency of Bombay, which produces about four-fifths of the total cotton manufactures of India. The industry was started at Bombay and long

1 This figure excludes transhipments at Indian ports, of which no record is kept.

remained restricted to that city and the neighbouring Districts, but in recent years mills have been erected in most other Provinces and in some Native States. The bulk of the exports consists of twist and yarn, of which a very large proportion is sent to China. The development of this important trade will be seen from the following figures :—

		lb.	Lakhs of rupees.
Average	1882-3 to 1891-2	104,603,447	3,96
"	1892-3 to 1901-2	191,326,425	7,38
Year	1902-3	248,538,638	8,54
"	1903-4	252,474,245	8,84
"	1904-5	247,855,000	9,82

The second decade was one of great depression due to the plague, which had a specially disturbing effect on the exports of cotton manufactures, while the trade was also affected by the war between Japan and China in 1894 and by other conditions prevailing in the latter country. The marked increase is thus strong testimony to the expansion of the industry.

The manufacture of cotton is, however, still largely limited to the spinning of yarn, the weaving of cloth being as yet a much smaller industry, the total value of cotton manufactures (exclusive of yarn) exported in 1904-5 being 182 lakhs, or less than one-fifth of the value of the exports of yarn. The foreign trade is increasing, but is never likely to become of so great importance as the home market.

Jute.

While the export trade in cotton manufactures has increased in such a degree as to attract special interest and attention, the rate of development in the exports of jute manufactures has been even more rapid :—

		Lakhs of rupees.
Average	1882-3 to 1891-2	1,87
"	1892-3 to 1901-2	5,54
Year	1902-3	9,02
"	1903-4	9,47
"	1904-5	9,94

An appreciable proportion of the increase must be assigned to the great rise in the price of raw jute which has taken place in the same period, such as may be expected when there is a constantly increasing demand for an article the production of which is practically a monopoly. But after making allowance for this cause, the rise in the value of jute manufactures represents a great increase in the quantity exported. The articles

are almost exclusively gunny-bags and gunny-cloth, the former for the packing of rice, wheat, other grains, oilseeds, and other articles which can be transported in sacks. The cloth is used chiefly for the packing of cotton, wool, and other fibres transported in bales. Both bags and cloth, besides being very extensively used in India for the purposes mentioned, are exported to every corner of the globe, and the only apparent limit to the expansion of the trade is the inadequacy of the supply of the raw material. The increase of this is a point of some importance, as prices may rise so high as to encourage the substitution of other fibres for the purposes for which jute is now employed.

Cotton and jute represent 21½ crores out of a total value of manufactured articles exported amounting to 29 crores, and thus include about three-fourths of the whole. Of the remainder the most important are tanned hides and skins, and lac.

The trade in hides and skins is subject to great fluctuations, following the vicissitudes of the season. In the bad year 1900-1 so great was the mortality among cattle that 27,000,000 hides and skins were exported; in the four following years the exports were 17, 19, 20, and 17½ millions respectively. These figures refer to tanned hides and skins only. Of raw hides and skins the exports in the same four years were about 28¾, 27, 28, and 31½ millions respectively. The fluctuations of the trade are also reflected in the values shown below, which are of interest as indicating the proportions of the trade; they are stated in lakhs of rupees: Hides and skins.

	1900-1.	1901-2.	1902-3.	1903-4.	1904-5.
Raw . .	6,99	5,58	5,54	5,84	7,05
Tanned . .	4,49	2,65	2,90	3,10	2,85
TOTAL	11,48	8,23	8,44	8,94	9,90

Various other manufactured, or partly manufactured, articles are shown in the returns of exports, the chief of which are metals and metalware, chemicals and drugs—including tobacco and opium—and oils. None of them, however, is of present importance, with the exception of opium[1]. The manufacture of tobacco is a promising industry. The export trade has grown steadily, while local consumption has increased; and if cigarettes can be produced to compete with the very cheap Other manufactures.

[1] The production and trade in opium are dealt with in chap. i of this volume, and the revenue derived from it in Vol. IV, chap. viii.

qualities now imported in great quantity for native consumption, there seems little doubt that the industry will attain large dimensions. In many parts of India almost all natives smoke from their early youth, and there is a distinct tendency towards the abandonment of the clumsy *hukka* in favour of cigars and cigarettes.

Food-grains. By far the most important part of the Indian export trade is the great traffic in food-grains, especially rice and wheat. It is at the same time very variable, for the occurrence of scarcity in India at once diverts to internal markets the grain which would otherwise be shipped, and the rise of prices in the country brings much larger profits to the dealer than could be obtained in European markets unaffected by the conditions temporarily existing in India. The decade ending in 1901–2 included several years of drought and scarcity, and in that respect compares unfavourably with the preceding ten years. From year to year the fluctuations in exports are striking, but the character of the seasons and their influence on the trade are best illustrated by the following figures:—

		Cwt.	Lakhs of rupees.
Average	1882–3 to 1891–2	48,267,117	17,82
”	1892–3 to 1901–2	42,268,345	17,89
Year	1902–3	63,220,629	25,48
”	1903–4	77,173,439	32,59
”	1904–5	102,021,341	41,11

Large as was the trade in 1903–4, a year of abundant harvests following a dreary succession of bad seasons, it had been exceeded in 1891–2, when a sudden demand for Indian wheat in Europe was responded to with such alacrity that prohibition was seriously suggested lest the local supplies should be unduly depleted.

Rice. Rice is mainly exported from Burma, to be used for distillation, for the manufacture of starch, and for food. Formerly the bulk of the rice exported from Burma consisted of 'cargo' rice, of which five-sixths was unhusked (or 'paddy') and only one-sixth husked. Gradually, with the extension of rice mills, the proportion of cargo rice has diminished, this description being replaced by husked and cleaned rice, to the great advantage of the trade. For the husk is used as fuel in the mills, the bran lying between the husk and the grain is exported at a good profit for pig-feeding, and a saving in freight is thus effected.

Wheat. Most of the exported wheat is now grown in the Punjab.

In the early days of the trade the principal source of supply was the United Provinces, whence wheat was sent to Calcutta for shipment. Later, as the railways enabled Bombay to compete with Calcutta for the export trade of Northern India, the sources of supply shifted westward and Bombay became the centre of the export trade. Within the last few years, however, Karāchi has come into the field, and from that port is now shipped by far the greatest part of the wheat exported from India.

Markets for rice and wheat.

Indian wheat is almost all shipped to Europe, most of it being intended for consumption in the United Kingdom. Rice, on the contrary, is exported to every quarter of the globe, not more than about half of the total exports being consumed in Europe. Large quantities are sent to the Straits and Ceylon, to other parts of Asia, to East Africa, to the West Indies, and to South America. Indian rice penetrates to every region to which the Indian or Chinese cooly finds his way. It is to be noted that other countries, such as Siam, Cochin China, and Java, are already competing with India in these markets. The total exports of rice and wheat in 1904–5 were the largest known: rice 49,000,000 cwt., wheat 43,000,000 cwt. The export of rice exceeded the highest previous record (in 1902–3) by 2,000,000 cwt., while in the case of wheat the highest limit reached in previous years had been 30,000,000 cwt. in 1891–2. The rice trade is conducted under conditions as regards the effects of the seasons which are unknown in other parts of India, for as yet no failure of the monsoon in Lower Burma has been recorded. The fluctuations of the export trade from Burma depend, however, upon conditions in other parts of India, since bad seasons cause the diversion to India of rice which would ordinarily be exported to foreign markets.

Oilseeds.

Next in importance to food-grains are oilseeds, the principal descriptions being linseed, rapeseed, *til* (sesame, or gingelly), cotton-seed, castor-seed, poppy-seed, and earthnuts. Linseed, rapeseed, and *til* stand out from the others in importance, these three constituting five-sevenths of the total. Practically all the oilseeds exported are sent to Europe for utilization in the soap and candle factories of the United Kingdom and the Continent, mainly France, Germany, and Belgium. The trade in cotton-seed is of very recent origin, but it has already attained considerable proportions. The magnitude of the commerce in oilseeds (the exports of 1904–5 having exceeded 26,575,000 cwt.) is rather surprising. Factories for pressing cotton-seed have been established, but up to the present their

experience has been the reverse of what would naturally be expected. It has been found more profitable to sell oil locally, and to export the cake produced. Meanwhile the exports of oilseeds continue to expand, though slowly, and subject to the fluctuations that affect all agricultural products.

Raw cotton.

The trade in raw cotton for several years seemed stationary, if not decreasing. This circumstance was due to two causes. The demand for cotton for consumption in the Indian mills has now attained very large proportions, and much cotton which used to be sent abroad is now manufactured in the country. Nor is it easy to augment the production so materially as to supply the deficiency, as the area in which cotton may be grown with profit is not susceptible of large increase. The second cause of the contraction of exports is that with the fall in the price of American cotton in recent years the continental spinners and weavers, who were the largest consumers of Indian cotton since the Lancashire mills gradually discarded it, found the use of American produce more profitable. Fortunately, while the European mill-owners were rejecting Indian cotton in favour of American, a demand arose for it in Japan, which is now the most important market. This demand and the expanding exports of cotton in the form of yarn, with the quantity required for local consumption, have tended to maintain cultivation without contraction of area. From time to time conditions in the United States cause a rise in prices, and a stimulus is given which increases the area under cotton. Ordinarily, however, it must be admitted that in the competition for external markets Indian cotton suffers under considerable disadvantages, for the average yield is very low compared with that of other countries, and the staple is so short and inferior that Indian cotton is included among the lowest grades quoted. It is thus probable that Indian cotton will continue to find its best and largest markets in the Indian mills and in Eastern Asia (Japan and China). The trade in the last two decades is shown in the appended figures:—

		Cwt.	Lakhs of rupees.
Average	1882-3 to 1891-2	5,420,148	14,33
,,	1892-3 to 1901-2	4,620,996	11,63
Year	1902-3	6,044,806	14,76
,,	1903-4	7,931,075	24,38
,,	1904-5	5,658,718	17,44

Some of the decline in the second decade must of course be attributed to the bad seasons in Western and Central India,

while the increase in 1902–3 was due to conditions in the United States which were maintained in the following year. A reaction set in, however, in 1904–5, with the appearance of an American crop of unprecedented magnitude.

While the increase in the spinning and weaving of cotton in India interfered with the growth of the export trade in the raw material, the same cannot be said of jute. Concurrently with the great development of the manufacturing industry on the banks of the Hooghly, the exports of the unmanufactured fibre have also largely increased, as will be seen from the following figures:— Raw jute.

		Cwt.	Lakhs of rupees.
Average	1882–3 to 1891–2	9,279,565	6,15
,,	1892–3 to 1901–2	11,771,835	9,54
Year	1902–3	13,036,486	11,13
,,	1903–4	13,721,447	11,72
,,	1904–5	12,875,312	11,97

The demand for jute in Europe continues active, owing to its increasing popularity in the manufacture, not only of packing cloth and bags as in earlier days, but of carpets and rugs, which though not durable are showy and very cheap. The consequence of the competition for the raw material between the Indian and European mills has been a steady and continued rise of price, a fact which accounts for the persistent efforts made in recent years to discover a fibre that may compete with jute. If such a fibre should be found and utilized, the price of jute must fall until it regains the merit it originally possessed, and still possesses, of being the cheapest fibre in the market.

The cultivation of tea in India, and its relative importance in different Provinces, have been sufficiently described in chapter i. The rapid growth of the export trade led to over-production and the preparation of inferior qualities, with the inevitable result of a marked fall in prices. In the discussion which followed, the majority of those interested in the tea trade favoured the maintenance of the Indian currency on a silver basis, in the hope that if prices were unprofitable compensation might be found in the continued fall in the exchange value of the rupee. A more reasonable remedy was the proposal to open up new markets for Indian tea. The great tea-drinking countries of the world are the United Kingdom, Russia, and the Australian Colonies; and in Russia alone is there much room for development, for in the other countries the consump- Tea.

tion has reached the point at which future increases can only take place with an increase of population. There are also possibilities of increased consumption and expanded trade in the United States and in Persia. It is even possible that in course of time China, which has been so largely superseded as an exporter, may import tea from India and Ceylon, even as India now imports far more sugar than she ever exported. In India itself the demand, which is at present insignificant, may develop considerably, but this will be the work of years. With the exception of some 7,000,000 lb., mainly consumed by the British troops and by the European and Eurasian communities, all the tea produced in India is exported, the United Kingdom being the best customer. The expansion of the trade and the fall in prices are shown by the following figures:—

		lb.	Lakhs of rupees.
Average	1882–3 to 1891–2	84,477,721	4,78
,,	1892–3 to 1901–2	151,072,394	7,91
Year	1902–3	181,423,518	7,36
,,	1903–4	207,159,793	8,56
,,	1904–5	212,813,971	8,53

Sugar. The export trade in sugar at one time attained considerable dimensions, though never of the first importance, but in quite recent years it has almost ceased. The manufacture is not very flourishing, but there is no reason to suppose that in the immediate future the area covered by sugar-cane will be restricted, or the output reduced. Competition with beet sugar in the European markets has rendered exports impossible, while another reason for the decline of the trade probably lies in the fact that the crop is hardly equal to the Indian demand, which has in recent years increased greatly with the advancing prosperity of the people, especially in the large towns. When the native of India is prosperous his consumption of sugar forthwith increases, and the demand for a larger supply has been accompanied by a desire for a better quality. Accordingly we find an increasing tendency to consume refined instead of raw sugar, although the latter still represents in the market perhaps nine-tenths of the Indian crop. This change in taste was first met by importations from Mauritius, and more recently, under the stimulus of the continental bounty system, by beet sugar in large quantities. The importation of beet sugar was, however, checked by the duties applied by the Government of India to sugar shipped from any bounty-giving state, and subsequently by the provisions of the

Brussels Convention. In 1904–5, Java, having lost the American market, became the chief source of supply.

The decline of the export trade, consisting mainly of raw sugar for refinement in England, is apparent from the following figures of the quantity exported :—

		Cwt.
Average	1882–3 to 1891–2	1,145,685
,,	1892–3 to 1901–2	733,654
Year	1902–3.	222,124
,,	1903–4.	212,542
,,	1904–5.	307,414

As a striking contrast attention is drawn to the figures of the imports of sugar in the same period :—

		Cwt.
Average	1882–3 to 1891–2	1,523,890
,,	1892–3 to 1901–2	3,550,781
Year	1902–3	5,462,196
,,	1903–4	6,333,843
,,	1904–5	6,936,817

This rapid increase is due in considerable measure to the heavy imports during the last few years of beet sugar from Germany and Austria-Hungary, and it has been somewhat hastily assumed to be entirely the result of the system of bounties in those countries. That the bounties have played an effective part in encouraging these imports is certainly true, but other appreciable causes have also been at work. In Western India very little sugar is grown, the conditions not being suitable; and the absence of large capital and consequent economy of manufacture, combined with the cost of railway transport, have hitherto made it impossible for growers in Northern India to compete with sugar imported from Mauritius. The first imports of continental beet sugar were an attempt to obtain a foothold in these markets. Immediately afterwards there came upon India the series of bad years which culminated in the great famine of 1901–2. These bad years more or less seriously affected all the sugar-growing tracts, and the reduction of supplies made it possible for beet sugar to be sold profitably in the Punjab and Bengal. The new sugar became rapidly popular, especially for confectionery, as it is white, while the native sugar varies in colour from dark brown to light yellow. Thus other causes combined with the bounties in stimulating the import of beet sugar, and it is practically certain that, in

any case, there is a large opening for such sugar in India. The cultivation in India is very large, but it cannot be extended in proportion to the increasing demand, while owing to its cost it recovers slowly from the effects of bad seasons. The crushing and manufacture are moreover conducted on crude and primitive methods. Taking all the existing conditions into consideration, it may be anticipated that, unless the Indian processes are replaced by large works in which economy is possible, there must be an increasing consumption of imported sugar in the future.

Indigo. The history of indigo cultivation and manufacture will be found in chapter i. Till the production of artificial indigo by chemical processes, at a price which competed with the natural dye, the industry was thriving. A fall in the price of Bihār indigo then began which threatened ruin to the planters, who have been forced to substitute other crops. The results were apparent for the first time in the exports of 1899–1900. The average exports in each decade of the twenty years ending 1901–2 were:—

	Cwt.
1882–3—1891–2	141,811
1892–3—1901–2	135,396

But these figures fail to indicate accurately the measure of the decline, which was not clearly marked until the last three years of the second decade above mentioned, when the exports fell to 111,420, 102,491, and 89,750 cwt. In 1902–3 the exports dropped still further to 65,377 cwt., and in 1904–5 to 49,252 cwt., being less than half the average of recent years of prosperity. Moreover, the passing away of the indigo monopoly is indicated by the fact that, as the quantity available for export decreased, prices also fell, while Bihār indigo ceased to be sought for as in other times. The inferior indigo of Northern India and Madras, manufactured in factories worked after native methods, will no doubt continue to serve a purpose, much of it being used in India, but this industry is of small importance compared with that of Bihār.

Coffee. The articles noticed above constituted nine-tenths of the value of the Indian export trade in 1904–5. Of the remaining tenth the most important are coffee, lac, wool, teak-timber, and vegetable oils, but they are of relatively small value. The trade in coffee (which is of excellent quality) has suffered much from the fall in prices caused by the development of coffee-planting in Brazil, and perhaps still more from disease, which

has had the effect of throwing much coffee land out of cultivation. The export trade has for some years been stationary or declining, but there was some increase in 1904–5, when about 330,000 cwt., valued at 166 lakhs, were exported.

The trade in lac is of the most speculative character, being subject to violent fluctuations arising from variations in the quantity of the product annually supplied by the forests, and from market manipulations in the United States, where lac is in largest demand. As lac is merely a forest product, it is impossible to anticipate any progressive increase in the supply, and the trade must necessarily continue to be restricted within fairly well-defined limits. In 1904–5 the exports were valued at 308 lakhs. Lac.

The wool exported from India comes mainly from the pastoral tracts of Bīkaner and Baluchistān; but the quality is very inferior in staple and in cleanliness, and the price obtained is lower than that of any wool offered on the English market. No considerable attempts have been made as yet by sheep-owners to breed sheep for wool, and the trade in consequence remains at a low level. During the ten years ending 1900 the average exports exceeded 25,000,000 lb. annually, the value being 121 lakhs. In 1904–5 the exports were 38,600,000 lb., valued at 189 lakhs. Wool.

The trade in teak-timber again is limited both by supply, which is regulated by considerations of forest conservancy, and by the demand, which hardly tends to increase now that wooden ships have been so largely replaced by steel. Teak.

The exports of vegetable oils are as yet small; and the trade is in the main confined to the neighbouring Asiatic countries, while the crushing of oilseeds in India on a large scale has not yet been found practicable. Vegetable oil.

IV. Imports and Exports of Treasure

The steady and long-continued absorption of the precious metals by India has already been referred to. It was indeed the fear of this drain of gold and silver which led the Spanish kings, after their acquisition of Portugal, to neglect the Indian trade in favour of that with America. Attacks were frequently made on the English East India Company, on the ground that the export of gold and silver was impoverishing the home country. Influx of precious metals.

Within the last few years the net imports of gold apparently diminished. Thus the excess of imports over exports during Gold.

the ten years ending 1891–2 averaged about 729,900 ounces, while during the following ten years the average did not exceed 442,400 ounces. The reduction is mainly due to two causes. Large imports of gold had been made by banks to be exchanged for silver, and the accumulation of gold coin having been found inconvenient by Government—for gold does not circulate freely in the country—the surplus was shipped by the Government to London, where at the same time considerable purchases of silver were made for additions to the coinage. Secondly, the Mysore gold mines now send to London large quantities of gold every year, and this export reduces the net imports shown in the trade returns. It is probable that on the whole there was no real decline in the demand for gold in India, which is in value about half of that for silver. In 1902–3 the net imports rose to 1,417,000 ounces, and in the following years to 1,566,237 and 1,516,991 ounces.

Silver. The net imports of silver during the ten years ending 1891–2 averaged about 32,753,500 ounces, while during the next ten years they averaged 35,437,600 ounces. The increase in 1902–3 to 43,274,305 ounces, and in 1903–4 and 1904–5 to 78,575,469 and 74,956,262 ounces, is less marked than the rise in the case of gold. There is indeed some evidence to show that gold is taking the place of silver in the hoards of the people.

V. *Distribution of Foreign Trade*

General distribution of foreign trade. The foreign trade of India is conducted with every continent and most of the countries in the world, but in very unequal proportions, a very few countries being of great importance, while the transactions with the rest are insignificant. The bulk of the trade is carried on with European countries, which supply four-fifths of the imports and receive half of the exports. Asiatic countries have the largest share of the remainder. The imports from Australia (largely consisting of horses and copper) do not seem likely to attain to large dimensions. Imports from Africa and America are also comparatively trifling, and would cease to have any importance if it were not for Mauritius sugar and American petroleum.

But while imports into India are so largely derived from Europe, the exports are far more widely distributed over the world. As mentioned above, not more than about half is sent to European countries, and the greater part of the remainder is destined for Asiatic ports. The African continent is shown in

the trade returns as receiving a considerable quantity; but this is in the main fictitious, owing to the assignment to Egypt of large shipments of rice and oilseeds consigned to Port Said for orders as to their ultimate destination, which is always some European port[1]. India still remains in essence an agricultural country, and needs every market which can be found for her raw products. In most of them, it may be noted, these raw products are admitted free of duty, as they are required for manufacture, and are moreover articles of which India is at present the chief source of supply.

While the exports of Indian goods consist practically of a few classes of raw materials described above, there is much variety in the nature of the goods imported.

Trade with United Kingdom.

The bulk of the foreign trade of India, since the British established themselves firmly in the country, has always been conducted with the United Kingdom. The close administrative and financial relations between the two countries are naturally accompanied by close and extensive commercial intercourse. England is a market for most of the productions shipped from India, and is also, to a diminishing extent, a centre for the storage and distribution to other countries of the articles not required for consumption in England. The monopoly of trade given to the East India Company, and the jealousy with which the Company resented any attempts on the part of Portuguese, Dutch, French, or other adventurers to secure a share of the profits, contributed largely to place the international trade in British hands. The main reasons, however, for the continued retention of the trade by the United Kingdom were the use of the route to India by the Cape of Good Hope, and the destruction of the mercantile marine of competing nations in the wars which continued down to 1815.

Reasons for its importance.

England then became the great carrier of the world; and the Indian trade, even where the merchandise was not British, was carried in British vessels from and to England, foreign goods for India being sent to England from the Continent for reshipment, and Indian goods for the Continent being sent to England for distribution. The Red Sea route was far too costly a mode of transit except for a very small class of expensive goods, and traffic with the Mediterranean always passed through a British port first. Before the opening of the Suez

[1] From 1903-4 the trade returns have shown more accurately the destination of exports, but complete information is not yet available.

Canal, the United Kingdom held the practical monopoly of all the European trade with India. The rest was carried on with China, the Straits, Ceylon, Persia, and other Asiatic regions, excepting a small trade of comparatively brief duration with the United States in the importation of ice, with apples stored in it, the first crude beginning of the frozen fruit trade.

Other nations obtained a share later.

The decline of the British share of Indian trade became inevitable as soon as the Suez Canal was opened and continental traders were able to undertake the direct conveyance of merchandise to and from India. It is clear that no trader in Marseilles, Bordeaux, Genoa, or Venice, would send his goods by the circuitous route through England when he was able to send them direct on reasonable terms of freight. This transfer of a part of the carrying trade, which has increased, though not very much, with the rise in commercial importance of continental nations, is the primary cause of the decline in the proportion of the trade of India conducted with England which has attracted some attention. It must be added that, as India's trade with other countries, such as parts of Asia, Africa, Australia, and the United States, expands, the decline in the proportion of the British share of Indian trade must necessarily become more marked. The trade with these countries does not, however, increase at all rapidly; and as the merchandise received from them does not usually enter into competition with merchandise from England, owing to its different nature, the cause for alarm seems remote.

Nature of trade with United Kingdom.

With these preliminary remarks, we may now examine the items of trade with England, and inquire how far there has been any substantial and avoidable displacement of British merchandise. The imports from the United Kingdom are of an extremely varied nature, almost every class of goods being sent to India; but though the list is formidable in length, 80 or 90 per cent. of the total value is taken up by a very small number of articles. The others are in the main articles of food, convenience, or luxury, principally for the use of British officials and non-officials. The articles which predominate by reason of their great aggregate value are the following, the value in 1904–5 being entered opposite each:—

	Crores of rupees.
Cotton:	
Twist and yarn	2.30
Grey (unbleached) goods	16.27
White (bleached) goods	8.00
Coloured and dyed goods, including prints and chintz	8.30

	Crores of rupees.
Metals	6.09
Machinery	3.83
Railway material	1.26
Hardware and cutlery	1.57
Apparel	1.15
Woollen goods	1.73

These seven categories represent about 80 per cent. of the total merchandise imported, while the remaining fifth includes a large number of more or less unimportant items. In the supply of these seven classes of goods, which are typical of the requirements of India from abroad, England stands predominant and unrivalled, and is likely to continue to hold this position, except perhaps in the matter of metals; for a demand for cheap and inferior iron and steel has arisen in India, this class of goods being largely made for export in Belgium and Germany, while the British manufacturer does not care to undertake the preparation of them.

Certain other articles of foreign manufacture, as for instance glassware, musical instruments, stationery, toys, and various small items, have an increased sale in India; but on the whole the displacement of British trade has been insignificant, and probably less marked than the substitution of foreign for British goods of similar classes in the United Kingdom.

Value of trade with United Kingdom.

The statistics of trade with the United Kingdom for the two decades ending 1901–2 show no reduction in the imports, although the increase was not as large as might have been anticipated. It should be borne in mind, however, that, owing to a fall in prices, the recorded values are not a fair measure of the movement of trade during the last ten years. In the case of exports there was an appreciable decline, which may be attributed to the increase in recent years of direct shipments to the Continent, and to the decline in the exports of Indian cotton, which Lancashire has now almost discarded. However, the three last years since 1901–2 show a notable increase of trade with the United Kingdom, in both imports and exports. The figures are (in lakhs of rupees):—

		Imports.	Exports.
Average	1882–3 to 1891–2	46,62	35,36
,,	1892–3 to 1901–2	48,83	32,84
Year	1902–3	52,28	32,38
,,	1903–4	55,06	41,25
,,	1904–5	63,06	43,12

Trade with Germany.

The value of the Indian trade with Germany has increased with great rapidity, as shown below (in lakhs of rupees), though here the rate of increase seems to have been checked in the three last years :—

		Imports.	Exports.
Average	1882-3 to 1891-2	48	1,77
,,	1892-3 to 1901-2	2,10	7,99
Year	1902-3	2,16	10,18
,,	1903-4	2,92	14,82
,,	1904-5	3,73	14,31

The increase is the more remarkable in view of the fact that the first appreciable rise in the trade did not occur until 1890-1. A summary view of this movement has led to the conclusion that British goods are being largely displaced in India by German manufactures, and fears have been expressed in some quarters that the displacement is serious. Such a conclusion is based on a misapprehension of the facts. If the imports of sugar and salt from Germany are excluded, the rest of the goods from that country represent such a relatively trifling value that the trade in them cannot reasonably be regarded as threatening in any way the prosperity of the British manufacturer. Small as the trade is, it includes a great diversity of articles, none of them being of a nature which admits of expansion in any material degree. The articles are in almost every case of flimsy construction, and sold very cheaply to suit the purses of the natives, to whom cheapness is the chief consideration. The growth in the trade in such articles is partly due to the inability of some of the purchasers to pay for more costly goods, and partly to the disinclination of others to buy expensive things even though they are more efficient or last longer. The latter tendency of the native purchaser is studied to a greater extent by the German than by the British manufacturer, with the result described above; but the process has been one of creating and developing a new demand, rather than the displacement of British goods.

Besides the numerous petty articles of an inferior description which in this way add to the value of the trade with Germany, there are some in the production of which German manufacturers have secured special advantages by the application of technical skill or chemical science, or a combination of both. For instance, the European community in India now, with few exceptions, buy German rather than English pianos, because the former are specially made at relatively low prices, and

therefore suit a community the members of which have frequently to change their residence. In the manufacture of mineral dyes from coal-tar the Germans have built up an enormous industry based upon large capital, and competition with them would now be a matter of great difficulty.

Correction of statistics.

The increase in the trade with Germany shown in the statistics quoted above is, however, to some extent fictitious. This is due to the fact that an active trade was formerly carried on in German merchandise imported into India through the United Kingdom in British vessels, before the development of the subsidized German mercantile marine encouraged the substitution of direct for indirect trade. It is not possible, however, to say what proportion of the increase should be deducted on this account. The development of German shipping, while it has encouraged direct imports, has also had a pronounced effect on the direct export to Germany of cotton, hides, jute, oilseeds, and rice, for manufactures in that country. It must also be borne in mind, on the other hand, that part of India's apparent trade with Belgium and Holland is really transit trade with Germany.

Trade with China.

Next to the United Kingdom, but lagging a long way behind, China does a larger business with India than any other country. It is not, however, a progressive trade; and having in view the increase in the population of both countries, the development of communications, and the cheapening of freights, a trade which has made no material advance must be regarded as declining. The decline is partly due to the fact that until within the last few years practically almost all the trade with Japan was conducted by way of China. Following the war with China in 1894 the Japanese reorganized their industrial and mercantile system on a new basis, and began direct trade with India.

Of the exports to China opium still remains of great importance; but it is almost equalled by cotton yarn, which will probably continue to be an increasing export until the Chinese follow the Japanese example and set up spinning and weaving mills of their own on a large scale. When that time arrives the trade in cotton yarn will perhaps be superseded by the export of raw cotton, to the detriment of the Indian spinning industry. The features of the opium trade with China will be described in Volume IV, chapter viii, and need not be referred to in detail here.

Trade with Japan.

Trade with Japan has increased very largely and very rapidly, for until 1896 it was insignificant. Part of the increase,

especially in the imports, may be attributed to the establishment of direct trade in place of the former trade through China, but most of it is new business. After the war with China a line of Japanese steamers was established to trade with Bombay, where a Japanese colony was soon formed under the protection of consular officials, and a branch of a large Japanese bank was also established in that city. Since then the trade has thriven. The imports are still comparatively unimportant; but it may be noted as an interesting feature that the Japanese speedily recognized the importance of the market presented by Burma for silk fabrics, and so successfully have they adapted their colours and designs to the taste of the Burmans that at present they seem likely to take possession of the whole market. The export trade is practically limited to raw cotton, but the demand is so large that Japan is now the largest external consumer of the Indian fibre.

Trade with other countries. France. There is but slow development in the import trade with other countries. France sends articles of a more or less special character, such as millinery, silks, brandy, wines, almost exclusively for the consumption of the European community in India. Any rapid increase in such a trade can hardly be looked for, and the demand for brandy and wines has been considerably reduced by the substitution of whisky.

The United States. Imports from the United States are not increasing; their maintenance at the present level is due to the demand for petroleum, and this article is becoming more and more subject to the competition of the Burma oil-wells.

British Colonies. India imports little from British colonies. Sustained efforts have been made to create a demand for Australian products and manufactures, but up to the present with indifferent success. The truth is that the market in India for such articles as Australia can send is not large in itself, while the field is already occupied by similar goods from England and the Continent, produced at rates with which the Australian colonies can hardly compete. When it is said that Indian trade with British colonies is not considerable, exceptions must be made in the case of Ceylon and Singapore. This, however, is of the nature of coasting trade and needs no remark.

VI. External Trade by Land

Smallness of external land trade. In addition to the foreign trade carried oversea, there is commerce with neighbouring countries across the vast Indian frontier from Baluchistān to Siam. This commerce is of small

dimensions, the total value in 1904–5 amounting to no more than 15·34 crores. The statistics are, however, very imperfect, for the registering stations on the frontiers are in most cases remote and difficult of access, and the clerks in charge cannot be effectively supervised. Some trade escapes registration altogether, as it passes by routes on which there are no registering stations. The values of merchandise are recorded in a rough and arbitrary way, over-estimation being probably much more frequent than under-estimation. Lastly, traders are too cautious to declare portable goods of value, such as coin or gold-dust. The figures must thus be accepted with very great reserve. Most of the trade is carried on across the immense ranges of the Hindu Kush and the Himālayas, over tracks and passes which for six or eight months of the year are impassable. Yaks, mules, ponies, sheep, goats, men, women, and children carry packages suited to their capacity, and a single journey across and back is full work for the open season.

Countries with which trade is carried on.

The statistics include a number of countries with which this commerce is conducted, but most of them are of no importance. Those with which an appreciably large trade is carried on are Afghānistān, Kashmīr, Nepāl, Western China, and the Shan States. But here again we have to make reservations and qualifications. The trade with Kashmīr is foreign only to the limited extent to which it consists of articles destined for, or received from, Central Asia. The great bulk of the trade is really with Kashmīr itself, and is thus, in present political conditions, no more foreign trade than is the trade which passes in and out of any Native State in India, such as Hyderābād or Mysore.

Nature of external land trade.

The more valuable portion of the land frontier trade consists of the export from India of foreign goods such as are commonly used in India—cotton yarn and piece-goods, hardware, sugar, salt, with similar articles of Indian origin; also petroleum (to Western China), tea, and a number of other articles, in varying quantity, but mostly of trifling value.

Obstacles to development.

Besides the physical obstructions mentioned above, this trade has in places to contend with obstructions placed in its way by the rulers of the adjoining countries. Thus merchandise sent to Afghānistān, on leaving the railway at Quetta or Peshāwar, must be transferred to the backs of camels or ponies, and is subject to heavy duties. Merchandise received from Afghānistān is also subject to restrictions, for the Amīr has established a monopoly of many of the articles in which trade is active, and these can be handled only by his agents or by

persons licensed by them. In these circumstances it is easy to see why the trade with Afghānistān is less than it was before the British handed over the government of the country to Abdur Rahmān in 1880. On the other hand, there has been a material increase in the trade with Dīr, Swāt, and Bājaur, which is largely due to the presence of British garrisons in the forts defending the Hindu Kush.

Kashmīr. Trade with Kashmīr has increased very greatly; but it has been observed already that this is not really foreign trade at all, and much of the increase is due to the increasing popularity of the valley as a summer resort for European officers, military and civil, and their families.

Nepāl. Trade with Nepāl fluctuates, but without making any considerable advance from year to year. A large proportion of this trade does not pass into or from Nepāl proper at all, but is trade between the Tarai, which was ceded by the British Government to Nepāl after the Mutiny, and the adjoining British Districts.

Tibet. Trade with Tibet has always been on a small scale, owing to the conditions of the country and the difficulties of communication. It has, however, been still more hampered by the policy of the Tibetans, and some improvement may be anticipated as a result of the treaty negotiated in 1904[1]. The roads to the frontier in British territory are gradually being improved.

Shan States. Like the trade with Kashmīr, the trade with the Shan States is internal rather than external. The question of the capabilities of this recent accession of territory, which is under the protection of British rule, is of the same nature as that of the productive and commercial capacity of a District of British India.

China. Trade with Western China appears to be increasing, though the increase has been very slow. The region between the frontier of Burma and the settled Chinese districts which are the destination of the merchandise exported is a mountainous tract, to the physical obstructions and dangers of which is added the risk of attacks by the murderous savages with whom this area is infested.

The rest of the frontier trade is of slight importance, and there is no immediate prospect that it will ever develop. Imperfect as the statistics are, Table VI (p. 313) serves to show the relative importance of the trade with the principal countries mentioned.

[1] See also Vol. IV, chap. iv.

VII. Internal Trade

General conditions.

The development of internal trade has been largely assisted by the removal of the hindrances referred to in describing foreign commerce. Under native rule insecurity and the absence of roads made progress impossible. The customs of the people were adjusted to such conditions. The great mass of the population were agriculturists, with wants of a primitive nature, easily met in most cases by the produce of their own land or the crude manufactures of village artisans. In the early part of the nineteenth century inland trade was most important in the Gangetic plain, where water-carriage was available. The construction of roads and still later of railways has rendered possible an enormous development, but a long period must pass before the habits of the people will change sufficiently to allow them to take full advantage of the facilities thus afforded.

Methods of inland trade.

Broadly speaking, the greater part of the internal trade remains in the hands of the natives, but the European firms which export agricultural produce are extending their agencies. Almost every village has at least one resident trader, who combines the functions of money-lender, grain-merchant, and cloth-seller. Markets are held at convenient centres on fixed days each week, and at many of the great religious fairs trade is by no means the least important object of the crowds of pilgrims attending. A large proportion of the surplus produce is handed over to the village dealer, while some is sold in the markets, and the rest to itinerant buyers. Small quantities are thus gradually brought to the larger towns and railways, and dispatched to the ports or other centres of commerce. The process of collection is thus complicated and hampered by an unnecessary number of middlemen. Imported merchandise is distributed by the same cumbrous machinery, working in the reverse direction. The growth or decay of towns has been largely affected by changes in trade, the chief factors being the presence or absence of railway communication. In the tracts where agricultural produce is available for export, bazars spring up at every railway station, and rapidly develop into thriving towns, while historic cities, left a few miles on one side, dwindle and lose their importance.

Trading castes.

Before the commencement of British rule the great Banjārā tribe, with numerous branches bearing different names, supplied most of the carriers; but the extension of railways has largely replaced pack animals. Almost every Province has its peculiar

trade castes. The Mārwāris of Rājputāna are, however, found almost everywhere, and in Assam they are of more importance than the natives of the Province. In Bombay the Pārsīs, by the boldness and extent of their operations, tread close upon the heels of the great English houses, while Lohānas, Vānis, Bohras, Memons, Khojas, and Lingāyats occupy different areas in the Presidency. Lingāyats are found also in Northern Madras and Mysore, but farther south Chettis and Komatis predominate. The traders of the Punjab are largely Khattrīs and members of the numerous castes included in the generic term of Baniā. In Bihār and the United Provinces Baniās take the lead, while in Bengal Brāhmans and a number of lower castes share different classes of trade.

Registration. No estimate can be given of the total volume of inland commerce. The most important statistics are those relating to rail-borne trade, which deal with India, excluding Burma, as forming sixteen blocks. These include nine British Provinces—Assam, Bengal, the United Provinces, the Punjab, Sind, the Central Provinces, Berār, Bombay, and Madras; the four principal ports—Calcutta, Bombay, Karāchi, and the Madras group; and three groups of Native States—Rājputāna and Central India, Hyderābād, and Mysore. Each of these is subdivided into minor blocks. River-borne trade is registered only between Bengal, Assam, and the United Provinces, and between the Punjab and Sind. There is no systematic record of the trade carried by road, though statistics are collected from time to time in different places, especially where new railways are contemplated. Tables VIII—IX show the trade of each Provincial block, and of the four chief ports in 1903–4. The valuation of inland trade is, however, difficult, and the figures must be used with caution.

Trade with ports. Internal trade falls into two main classes, traffic with the ports, and commerce between different parts of the country. The former is largely concerned with the collection of produce and manufactures for export, and the distribution of imported goods. With the growth of mill industries, especially in Bombay and Calcutta, the port towns are now receiving a considerable quantity of raw material, which is manufactured and distributed in the country. The division of the trade of each port between different Provinces is shown in Table IX.

Calcutta. Calcutta serves Bengal, the United Provinces, and Assam, from which it receives jute, coal, rice, opium, oilseeds, tea, hides and skins, grain and pulse, and *ghī*; supplying European cotton goods, gunny-bags, salt, rice, kerosene oil, and metals.

The traffic of Bombay city is gathered from a larger area, including, besides the Presidency itself, Rājputāna and Central India, the Central Provinces, Berār, the United Provinces, and Hyderābād. Nearly half the total value of the imports into Bombay city in 1903–4 was represented by raw cotton. Oilseeds, opium, wheat, and other food-grains were the other chief articles imported. The principal commodities distributed were European cotton goods, metals, sugar, and cotton goods of Indian manufacture. Bombay.

The eight Madras seaports trade chiefly with the Presidency within which they are situated, but have also some commerce with Mysore and Hyderābād. They receive raw cotton, hides and skins, provisions, leather, rice, earthnuts, and spices. About one-fifth of the value of what they distribute consists of European cotton goods, and the remainder includes a large variety of merchandise, of which metals and spices form the chief groups. Madras ports.

Karāchi receives four-fifths of the exports of the Punjab, and supplies more than half of the merchandise imported by that Province. It also engrosses the smaller trade of Sind. Wheat and raw cotton make up three-quarters of the imports, while European and Indian cotton goods, metals, and sugar are the chief articles distributed. Karāchi.

The inland trade of Burma by rail and river is not registered, but the most important item received at Rangoon and the other ports is rice. Teak, hides, petroleum, cutch, and india-rubber are also sent in considerable quantities. The articles distributed inland are chiefly cotton and silk goods, metals, salted fish, liquors, and sugar. Rangoon.

There is a considerable coasting trade from port to port in British India and the Native States, the value of which was 42·6 crores in 1904–5. The greater part of this trade is between Burma and the ports on the western shores of the Bay of Bengal, especially Calcutta, and along the coast between Bombay and Karāchi. Food-grains, chiefly rice, are the principal items. Burma sends rice to Bengal, Madras, and Bombay, and Bengal also supplies Madras. Calcutta is the largest market for mineral oil from Burma, and redistributes part of it by sea to Madras and even Sind. Bengal coal and gunny-bags exported to Bombay and Sind are chiefly carried by sea. Piece-goods, rice, salt, cotton, timber, and coco-nuts are the principal items of trade on the Bombay coast. Coasting trade.

The difficulty of forming an estimate of the volume of trade between different parts of India has already been mentioned. Trade between Provinces and States.

Comparisons of the figures for a series of years are vitiated by the rapid extension of railways, which supply the chief statistics, and violent fluctuations occur owing to variations in agricultural prosperity. In 1904 the railways carried 52,000,000 tons, nearly a quarter of which consisted of grains and seeds; in 1900, when famine was severe in Western India, the railway traffic amounted to only 33,000,000 tons, but grains and seeds formed more than a third of the total. The variations are more clearly illustrated by Table VII (p. 314), which shows the weight of the principal articles of commerce imported into British Provinces and Native States from other Provinces and States and the chief seaports in India, excluding Burma, during the years 1899–1900 and 1904–5. In ordinary years the grain traffic consists chiefly of rice, gram and pulse, and wheat; and while the movement of these increases largely in unfavourable years, a still greater rise takes place in the case of the millets, *jowār* and *bājra*, which form the chief food of the lower classes in many parts of India. A continuous and rapid development is to be noticed in the case of coal, and the trade in sugar, salt, and kerosene is increasing; but the weight of metals carried is liable to great variations determined by their market value and the condition of the people.

Assam. The trade of Assam is almost entirely confined to Bengal. In addition to the foreign trade conducted through Calcutta and Chittagong, the exports include coal, jute, and rice, and the imports piece-goods, gram and pulse, rice, salt, and sugar. The scattered position of the tea-gardens and the difficulties of communication prevent the concentration of trade in large towns, and the commerce of Assam is carried on at a number of small centres.

Bengal. Excluding the foreign trade of Calcutta, Bengal deals chiefly with the United Provinces, Assam, and the Central Provinces. From the first of these it receives sugar, oilseeds, opium, gram and pulse, wheat, and cotton goods of Indian manufacture, giving in return coal, rice, kerosene oil, gunny-bags and cloth, sugar, tobacco, and lac. Assam supplies tea, coal, timber, hides and skins, and rice; and receives rice, spices, kerosene oil, and sugar. Trade with the Central Provinces is on a smaller scale, the exports being chiefly raw silk, sugar, coal, kerosene oil, and rice; and the imports cotton manufactures. Chittagong is a rising port, but its traffic is still small. Nārāyanganj, Sirājganj, Chāndpur, Mādārīpur, and Jalpaigurī are centres of the jute trade; Rānīganj, Asansol, Gīrīdīh, Purūlia, and Barākar export coal; and Patna is still important in the

grain trade. Calcutta, with its suburbs, is the chief centre of commercial and industrial activity.

Bombay. The chief imports into the Bombay Presidency, excluding the port of Bombay, are raw cotton and grain. The former is received chiefly from Rājputāna and Central India, Hyderābād and Berār; while Madras, the United Provinces, and Central Provinces supply grain. Raw sugar from the United Provinces is also a large item of the import trade. The chief exports are cotton goods supplied to the United Provinces, Rājputāna and Central India, Madras, and the Punjab; salt to the Central Provinces and the adjacent Native States; and tobacco to Rājputāna and Central India. Ahmadābād, Surat, Bhusāwal, Poona, Sholāpur, and Hubli are the chief commercial centres in the Presidency proper, and Hyderābād and Sukkur in Sind.

Burma. Burma supplies to other parts of India rice and kerosene oil, which are sent largely to Bengal, and in smaller quantities to Madras and Bombay. It imports provisions and vegetable oils from Madras, cotton goods from Bengal and Bombay, and gunny-bags from Bengal. For the coasting trade, Akyab, Moulmein, Bassein, Tavoy, and Mergui are most important after Rangoon; while Mandalay, Bhamo, Pakokku, Prome, Henzada, and Myingyan are the chief centres of inland trade.

Central Provinces and Berār. Trade in the Central Provinces and Berār is very largely dependent on agricultural conditions. Nearly 90 per cent. of the total value is absorbed by the trade with Bombay city. Bengal supplies coal, gunny-bags, and silk; and receives cotton twist and yarn, sugar, and rice. Bombay sends salt, sugar, and leather, in exchange for gram, pulse, and rice; and the United Provinces send sugar. Nāgpur, Jubbulpore, Kamptee, Raipur, and Hinganghāt are the principal trade centres.

Madras. Madras has comparatively little rail-borne trade with other Provinces, but supplies Mysore and Hyderābād with grain, provisions, cotton goods, and sugar. It receives hides, skins, and leather from these States, and in smaller quantities from other parts of India. A large proportion of the coal extracted from the Singareni mines in Hyderābād is also taken by this Presidency. The chief ports, after Madras itself, are Tuticorin, Cochin, Calicut, Mangalore, Cocanāda, Tellicherry, and Negapatam. Small inland trade centres are numerous.

Punjab. Two-thirds of the trade of the Punjab is with the port towns, Karāchi having by far the largest share. Apart from this, the Province supplies cotton goods and salt to the United Pro-

vinces, and grain and pulse to the United Provinces, Rājputāna, and Central India. The United Provinces supply sugar, rice, and coal; Rājputāna, salt; Bombay, cotton goods of Indian manufacture; and Bengal, coal, rice, and gunny-bags. The large cities—Delhi, Lahore, Amritsar, and Multān—absorb a considerable share of provincial trade, but grain markets have recently sprung up at many places in the tracts where wheat is grown for export.

United Provinces.

Cotton goods form about one-third of the imports of the United Provinces. They are received chiefly from Calcutta, and in smaller quantities from Bombay. The trade in metals varies, but Bombay is the chief source of supply. Salt is imported from Rājputāna, Bombay, and the Punjab; and kerosene oil and coal from Bengal. The exports include wheat, oilseeds, hides and skins, raw cotton, and opium, all of which are items of foreign trade. Calcutta has the chief share in these, but Bombay also receives raw cotton and oilseeds. The United Provinces, which are exceptionally well served by railways, conduct a larger business in purely inland trade than any other part of India. Sugar and *ghī* are supplied to Rājputāna and Central India, the Punjab, Bombay, and Bengal; gram and pulse are sent to Bengal and Bombay; and rice to the Punjab, Rājputāna, and Central India. Cawnpore, Agra, and Hāthras are the chief trade centres, the first-named being perhaps the most important inland town in India from the commercial and industrial point of view. The Provinces contain a number of other towns the trade of which is rapidly increasing.

BIBLIOGRAPHY

Sir G. Birdwood.—*Report of Her Majesty's Commission for the Paris Universal Exhibition of* 1878.

Sir W. W. Hunter.—*A History of British India.* 2 vols. (1899-1900.)

Views of the Government of India on the Question of Preferential Tariffs in their Relation to India. (Calcutta, 1904.)

H. J. Tozer.—*British India and its Trade.* (1902.)

H. J. Tozer.—'The Growth and Trend of Indian Trade: A Forty Years' Survey' (*Society of Arts' Journal*, March, 1901.)

Annual Reviews of the Trade of India. (Calcutta.)

Annual Reports on Rail and River-borne Trade, published by *Local Governments.*

TABLE I

VALUE OF IMPORTS AND EXPORTS OF MERCHANDISE, 1882–3 to 1904–5

	Imports.	Exports.		
		Indian.	Foreign (i.e. re-exports).	Total.
	Rs.	Rs.	Rs.	Rs.
1882–3	50,00,30,405	80,59,81,554	2,80,27,095	83,40,08,649
1883–4	52,70,38,912	85,08,57,205	3,03,55,753	88,12,12,958
1884–5	53,14,93,110	80,31,32,079	2,88,73,204	83,20,05,283
1885–6	51,81,15,365	80,73,47,311	3,09,31,090	83,82,78,401
1886–7	58,66,14,618	84,90,89,949	3,51,96,655	88,42,86,604
1887–8	62,38,48,130	86,37,00,218	4,10,14,403	90,47,14,621
1888–9	66,57,03,181	92,64,27,346	4,33,54,369	96,97,81,715
1889–90	66,56,01,205	99,10,10,546	4,29,58,078	103,39,68,624
1890–1	69,03,48,999	95,90,21,928	4,23,35,290	100,13,57,218
1891–2	66,58,74,568	1,03,55,08,310	4,48,51,791	108,03,60,101
Average	59,74,66,849	88,92,07,644	3,67,89,773	92,59,97,417
1892–3	62,60,50,303	1,01,94,57,065	4,59,02,900	106,53,59,965
1893–4	73,95,69,567	1,02,01,56,150	4,43,19,752	106,44,75,902
1894–5	70,16,74,378	1,03,75,74,382	5,05,75,608	108,81,49,990
1895–6	69,31,63,952	1,09,54,51,610	4,71,79,790	114,26,31,400
1896–7	71,79,38,293	99,88,06,600	4,03,36,372	103,91,42,972
1897–8	69,26,66,625	93,78,61,010	3,75,11,720	97,53,72,730
1898–9	68,38,03,412	1,09,35,02,765	3,37,11,965	112,72,14,730
1899–00	70,71,18,634	1,05,68,36,961	3,29,24,912	108,97,61,873
1900–1	76,27,78,853	1,04,16,04,984	3,20,85,314	107,36,90,298
1901–2	81,51,89,794	1,21,20,50,631	3,25,98,163	124,46,48,794
Average	71,39,95,381	1,05,13,30,216	3,97,14,649	109,10,44,865
1902–3	78,78,79,084	1,25,87,97,516	2,93,56,132	128,81,53,648
1903–4	84,82,32,930	1,49,63,40,735	3,32,55,087	152,95,95,822
1904–5	96,67,80,884	1,54,12,74,199	3,37,25,945	157,50,00,144

TABLE II

FOREIGN SEA-BORNE TRADE (IMPORTS) OF BRITISH INDIA, 1904–5

ARTICLES.		Quantity.	Value.
			Rs.
Apparel		. . .	2,23,99,627
Arms, Ammunition, &c.		. . .	28,17,214
Books, Paper, and Stationery		. . .	1,30,32,023
Coal, Coke, &c.	tons	259,393	44,46,447
Cotton (Raw)	cwt.	192,554	63,85,391
Cotton Twist and Yarn	lb.	30,575,855	2,48,76,477
Cotton Piece-goods and Manufactures	yds.	2,290,111,360	33,78,40,827
TOTAL Cotton and Cotton Goods		. . .	38,68,53,502
Drugs and Medicines		. . .	70,73,921
Dyes		. . .	92,68,005
Fruits and Vegetables		. . .	8,42,954
Glass, and Manufactures of		. . .	1,12,57,101
Gums and Resins	cwt.	132,766	16,39,712
Hardware, Cutlery, and Plate		. . .	2,39,59,612
Hides and Leather		. . .	46,60,669
Horses	No.	14,389	55,47,939
Instruments and Appliances		. . .	74,39,671
Ivory		. . .	18,60,242
Jewellery and Precious Stones		. . .	1,05,24,233
Liquors—			
Ale, Beer, and Porter	gals.	4,607,530	60,41,973
Spirits	"	1,459,329	98,80,154
Wines and Liquors	"	333,678	27,98,113
TOTAL Liquors	"	6,406,556	1,87,39,733
Machinery and Millwork		. . .	4,02,72,419
Matches		. . .	48,95,283
Metals—			
Iron	tons	257,580	3,81,38,342
Steel	"	211,581	2,34,03,379
Brass	cwt.	9,810	5,76,181
Copper	"	427,233	2,10,89,527
Spelter	"	82,903	14,62,450
Tin	"	39,323	39,36,023
German Silver	"	22,735	19,17,623
Lead	"	134,057	18,40,581
Quicksilver	lb.	238,562	3,90,757
Unenumerated	cwt.	15,975	7,20,744
TOTAL Metals	tons	505,869	9,34,75,607
Kerosene	gals.	76,190,067	2,92,99,466
Other Oils	"	8,505,135	51,75,603
Paints and Colours		. . .	46,91,972
Perfumery		. . .	2,82,401
Porcelain and Earthenware		. . .	29,31,813
Provisions		. . .	2,16,57,985
Railway Plant and Rolling-stock		. . .	1,40,96,585
Salt	tons	486,980	71,12,979
Ships, parts of		. . .	24,98,000
Silk (Raw)	lb.	1,858,709	73,41,121
Silk Manufactures	yds.	24,857,200	1,68,59,676
TOTAL Silk and Silk Goods		. . .	2,85,22,623

TABLE II (*cont.*). FOREIGN SEA-BORNE TRADE (IMPORTS) OF BRITISH INDIA, 1904–5

ARTICLES.		Quantity.	Value.
			Rs.
Soap	cwt.	164,624	27,23,705
Spices	lb.	1,14,847,322	1,03,23,550
Sugar	cwt.	6,936,817	6,90,27,319
Tea	lb.	3,734,579	18,96,015
Tea Chests		. . .	20,86,531
Tobacco		5,083,189	55,62,850
Toys and Games		. . .	27,73,710
Umbrellas	No.	2,129,463	18,95,064
Wood, and Manufactures of		. . .	65,57,946
Wool (Raw)	lb.	2,117,734	6,80,643
Wool, Manufactures of	yds.	23,742,250	1,94,53,864
TOTAL Wool and Woollen Goods		. . .	3,14,44,924
All other Articles		. . .	4,52,13,929
TOTAL Merchandise (Private)		. . .	96,67,80,884
Treasure (Private)—			
Gold		. . .	21,81,19,745
Silver		. . .	11,21,55,553
TOTAL Merchandise and Treasure (Private)		. . .	129,70,56,182
Government Imports—			
Merchandise		. . .	7,73,44,570
Treasure		. . .	6,48,06,452
GRAND TOTAL of Imports		. . .	143,92,07,204

TABLE III. FOREIGN SEA-BORNE TRADE (EXPORTS) OF BRITISH INDIA, 1904–5

ARTICLES.		Quantity.	Value.
			Rs.
Animals	No.	300,596	20,73,369
Apparel	.	...	33,94,805
Bristles and Fibre for Brushes and Brooms	cwt.	81,290	18,39,854
Coal and Coke	tons	594,850	46,54,016
Coffee	cwt.	330,277	1,66,28,198
Coir, and Manufactures of (excluding Cordage)	,,	528,754	53,20,921
Cotton (Raw)	,,	5,658,718	17,43,81,742
Cotton Twist and Yarn	lb.	249,154,477	9,90,69,426
Cotton Manufactures		...	3,08,01,830
TOTAL Cotton and Cotton Goods		...	30,42,52,998
Drugs and Medicines		...	22,37,304
Indigo	cwt.	49,252	83,46,073
Other Dyeing and Tanning Substances	,,	1,322,741	58,51,599
TOTAL Dyes and Tans (except Lac)		1,371,993	1,41,97,672
Fodder, Bran, and Cattle Food, &c.—			
Oilcake	cwt.	1,404,631	43,08,621
Rice Bran	tons	167,529	44,00,086
Other Sorts	cwt.	345,526	10,12,409

TABLE III (*continued*).

FOREIGN SEA-BORNE TRADE (EXPORTS) OF BRITISH INDIA, 1904–5

ARTICLES.		Quantity.	Value.
			Rs.
Fruits and Vegetables	.	...	31,08,593
Grain: Rice (including Paddy) .	cwt.	49,450,464	19,60,69,513
Wheat (including Flour) .	,,	44,031,997	18,59,82,302
Other Grains . . .	,,	8,538,880	2,90,45,438
TOTAL Grain . . .	,,	102,021,341	41,10,97,253
Gums and Resins	,,	98,528	17,02,977
Hemp, and Manufactures of .	.	...	44,84,410
Hides and Skins . . .	No.	48,931,496	9,90,59,720
Horns	cwt.	61,787	14,46,639
Ivory, and Manufactures of .	.	...	5,85,934
Jewellery and Precious Stones .	cwt.	...	19,17,313
Jute (Raw)	,,	12,875,312	11,96,56,462
Jute, Manufactures of—			
Bags	No.	201,436,286	4,75,54,310
Yards	.	575,512,197	5,11,61,184
Other Kinds	.	...	6,76,129
TOTAL Jute and Jute Goods	.	...	21,90,48,085
Lac, Dye, Shell, &c. . . .	cwt.	2,40,131	3,07,64,121
Manganese Ore	,,	3,618,909	24,07,681
Manures	tons	78,068	43,77,841
Mica	cwt.	19,575	14,68,986
Oils	.	...	1,10,97,312
Opium	chests	66,861	10,62,34,442
Provisions	.	...	84,69,357
Saltpetre	cwt.	348,741	36,23,823
Seeds	,,	26,875,845	14,41,16,060
Silk (Raw)	lb.	1,398,185	51,18,704
Silk, Manufactures of . .	.	...	13,32,544
TOTAL Silk and Silk Goods		...	64,51,248
Spices	lb.	32,620,687	73,45,666
Sugar	cwt.	307,414	24,25,346
Tea	lb.	212,813,971	8,52,86,870
Tobacco	,,	13,395,334	21,09,376
Wood, and Manufactures of .	.	...	79,76,672
Wool (Raw)	lb.	43,748,524	2,15,06,694
Wool, Manufactures of . . .	.	...	28,66,958
TOTAL Wool and Woollen Goods		...	2,43,73,652
All other Articles	.	...	1,97,06,314
TOTAL Merchandise* (Private)		...	157,50,00,144
Treasure (Private)—			
Gold	.	...	3,69,85,896
Silver	.	...	4,27,79,760
TOTAL Merchandise and Treasure (Private)	.	...	165,47,65,800
Government Exports—			
Merchandise	.	...	20,77,085
Treasure	.	...	8,45,22,511
GRAND TOTAL of Exports	.	...	174,13,65,396
* Indian Produce or Manufactures		...	154,12,74,199
Foreign Merchandise . .	.	...	3,37,25,945

TABLE IV. DISTRIBUTION OF IMPORTS AND EXPORTS (INCLUDING RE-EXPORTS) BY COUNTRIES IN 1899–1900 AND 1904–5

(Exclusive of Government Stores, and of Government and Private Treasure.)

	1899–1900.				1904–5.			
	Imports.	Exports.	TOTAL.	Percentage of Value on Grand Total.	Imports.	Exports.	TOTAL.	Percentage of Value on Grand Total.
EUROPE.	Rs.	Rs.	Rs.		Rs.	Rs.	Rs.	
United Kingdom	48,75,31,911	31,71,38,416	80,46,70,327	44·78	63,05,92,188	43,11,67,001	1,06,17,59,189	41·77
France	1,02,58,817	6,66,44,990	7,69,03,807	4·28	1,80,52,010	9,55,95,127	11,36,47,137	4·47
Italy	74,01,179	2,76,34,157	3,50,35,336	1·95	1,24,19,924	4,29,98,490	5,54,18,414	2·18
Holland	31,04,761	42,60,246	73,65,007	0·41	59,86,695	2,41,89,608	3,01,76,303	1·17
Austria	2,38,33,498	1,71,57,327	4,09,90,825	2·28	4,00,82,803	4,69,80,439	8,70,63,242	3·42
Belgium	1,83,60,307	3,43,45,636	5,27,05,943	2·93	3,52,01,523	8,39,93,841	11,91,95,364	4·69
Germany	1,68,48,890	7,53,10,193	9,21,59,083	5·13	3,73,23,084	14,30,60,676	18,03,83,760	7·10
Russia	2,40,14,727	12,40,549	2,52,55,276	1·41	1,67,27,163	58,29,424	2,25,56,587	0·89
Other Countries	27,95,200	29,25,812	57,21,012	0·32	24,73,339	1,74,02,222	1,98,75,561	0·80
TOTAL	59,41,49,290	54,66,57,326	1,14,08,06,616	63·49	79,88,58,729	89,12,16,828	1,69,00,75,557	66·49
ASIA.								
China	1,59,63,866	14,21,53,993	15,81,17,859	8·80	1,92,31,113	19,70,61,629	21,62,92,742	8·51
Japan	49,99,519	6,35,64,937	6,85,64,456	3·82	1,17,33,391	9,74,51,069	10,91,84,460	4·30
Java	27,43,688	7,31,007	34,74,695	0·19	2,01,75,211	45,25,404	2,47,00,615	0·97
Straits Settlements	1,93,55,717	5,80,00,405	7,73,56,122	4·30	3,05,85,198	6,45,14,862	9,51,00,060	3·74
Ceylon	61,46,102	4,29,40,565	4,90,86,667	2·73	62,28,013	5,11,21,499	5,73,49,512	2·26
Persia	82,79,332	1,11,13,528	1,93,92,860	1·08	44,10,716	1,07,52,754	1,51,63,470	0·60
Turkey	43,98,719	55,83,263	99,81,982	0·56	36,78,607	1,23,09,191	1,59,87,798	0·63
Arabia	80,82,248	93,25,170	1,74,07,418	0·97	70,72,619	1,92,92,080	2,63,64,699	1·04
Aden	14,85,878	1,02,88,122	1,17,74,000	0·66	27,33,214	1,43,49,423	1,70,82,637	0·67
Other Countries	26,66,553	28,12,433	54,78,986	0·30	92,90,807	91,92,687	1,84,83,494	0·73
TOTAL	7,41,21,622	34,65,13,423	42,06,35,045	23·41	11,51,38,889	48,05,70,598	59,57,09,487	23·45
AFRICA.								
Egypt	22,09,261	5,38,44,399	5,60,53,660	3·12	60,67,159	1,32,85,509	1,93,52,668	0·76
Mauritius	1,64,77,957	1,03,37,421	2,68,15,378	1·49	1,98,80,636	1,20,73,871	3,19,54,507	1·26
Eastern Coast Ports	30,26,303	1,24,90,614	1,55,16,917	0·87	30,56,309	1,68,59,832	1,99,16,141	0·78
Other African Ports and Islands	73,218	94,50,774	95,23,992	0·53	4,19,339	92,77,518	96,96,857	0·38
TOTAL	2,17,86,739	8,61,23,208	10,79,09,947	6·01	2,94,23,443	5,14,96,730	8,09,20,173	3·18
AMERICA.								
United States	1,24,21,095	7,61,94,498	8,86,15,593	4·93	1,48,57,414	9,73,15,422	11,21,72,836	4·41
Other Countries	2,76,925	1,82,66,175	1,85,43,100	1·03	3,17,956	3,73,28,373	3,76,46,329	1·48
TOTAL	1,26,98,020	9,44,60,673	10,71,58,693	5·96	1,51,75,370	13,46,43,795	14,98,19,165	5·89
AUSTRALASIA.								
Australia, including Tasmania and New Zealand	43,62,963	1,60,07,243	2,03,70,206	1·13	81,84,453	1,70,72,193	2,52,56,646	0·99
GRAND TOTAL	70,71,18,634	108,97,61,873	179,68,80,507	100·00	96,67,80,884	157,50,00,144	254,17,81,028	100·00

TABLE V

DISTRIBUTION OF PRINCIPAL EXPORTS OF RAW PRODUCE IN 1899–1900 AND 1904–5 (in cwts.)

COUNTRIES.	RICE.		WHEAT.		OILSEEDS.		COTTON.		JUTE.		HIDES AND SKINS.	
	1899-1900.	1904-5.	1899-1900.	1904-5.	1899-1900.	1904-5.	1899-1900.	1904-5.	1899-1900.	1904-5.	1899-1900.	1904-5.
United Kingdom	3,910,080	4,378,780	5,297,767	28,928,757	3,277,471	7,200,999	132,590	346,515	4,505,652	5,160,399	200,612	78,657
Austria-Hungary	78,390	3,964,615	..	..	238,036	403,143	204,297	456,276	420,547	799,124	71,173	100,855
Belgium	2,713	850,043	2,122,710	7,588,857	2,301,764	3,541,465	297,576	667,871	..	77,247	15,060	5,211
France	6,367	439,129	876,848	3,428,374	4,893,415	7,093,392	177,887	234,990	641,417	1,296,411	127,387	44,023
Germany	520,960	5,545,994	13,101	1,195,533	2,928,242	5,070,021	531,172	1,025,256	1,883,859	2,702,683	336,352	276,489
Holland	8,092	3,394,098	69,810	371,284	370,871	1,422,574	100	16,688	..	5,571	5,029	7,509
Italy	115	115,695	248,064	23,400	938,065	1,332,916	370,343	627,281	360,608	489,505	134,651	118,855
Spain	..	..	88,000	531,816	..	20,710	19,691	126,690	68,203	234,487	4,553	40,408
Japan	349,842	9,277,239	..	15,683	847	24,433	2,319,173	1,950,905	3,800	33,084	..	82
China	8,100	343,215	4,596	76,484	114	60,283	284,586	172,154	35,008	9,758	493	168
Egypt	11,390,463	549,919	933,777	262,464	382,829	183,885	..	507	85,286	..	19,813	65
United States	1,975	4,026	..	50,050	10,028	60,047	762	1,942	1,714,231	1,928,622	491,639	375,049
Ceylon	5,550,789	6,176,291	603	806	32,075	57,695	7,941	8,516	225	260	7	284
Straits Settlements	4,235,067	5,415,145	2,325	14,433	15,834	31,764	16,845	473	972	90	1,700	2,127
South America	1,685,024	1,527,323	..	..	72,242	25,045	..	..	..	..	..	..
Mauritius	1,120,568	1,193,641	6,079	5,471	1,042	1,105	99	132	..	..	..	..
Arabia	842,279	1,197,748	12,189	162,580	6,364	20,578	1,012	2,297	..	17	16	34
East Africa	1,183,640	1,112,081	7,504	8,566	732	294	2,972	52	..	..	3	5
Turkey in Asia	8,192	928,355	12	3,958	142	416	4	52	..	..	122	9,947
Persia	155,751	139,193	3,265	12,641	936	1,335	414	90	..	..	456	259

TABLE VI

Land-borne Foreign Trade for Five Years ending 1904–5

	Landward Imports into India.					Landward Exports from India.				
	1900-1.	1901-2.	1902-3.	1903-4.	1904-5.	1900-1.	1901-2.	1902-3.	1903-4.	1904-5.
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
Baluchistān and Seistān	14,27,689	16,45,252	11,93,098	11,10,776	12,00,039	9,02,949	13,27,647	6,75,056	7,55,988	12,53,888
Afghānistān . .	54,90,869	62,44,296	45,91,427	60,98,126	66,22,901	51,29,067	67,09,150	71,55,535	77,59,889	1,05,66,119
North-west Frontier Tribes . . .	44,01,435	46,21,734	41,14,743	39,10,410	44,92,519	73,96,354	80,35,147	71,17,711	64,23,107	74,37,453
Kashmīr . . .	1,29,15,295	1,34,01,754	1,02,14,778	1,19,13,186	1,13,89,700	95,63,974	1,23,65,616	1,03,02,989	1,16,95,699	1,10,07,366
Ladākh . . .	4,18,169	7,40,482	6,77,555	6,20,719	10,53,797	2,16,703	3,01,793	2,54,066	3,07,091	3,08,056
Tibet . . .	15,19,295	18,38,154	19,90,229	12,91,592	11,95,286	10,12,619	11,34,271	11,52,672	7,70,108	10,43,468
Nepāl . . .	2,35,59,049	2,47,01,376	2,43,84,439	2,58,66,958	2,53,98,929	1,63,02,143	1,62,18,308	1,40,45,777	1,34,02,493	1,45,65,778
Sikkim and Bhutān .	7,54,417	10,81,402	8,20,178	11,92,816	9,01,422	4,61,277	6,03,756	4,64,850	5,11,627	5,63,654
North-eastern States beyond the Bengal and Assam frontier .	9,28,227	8,10,955	6,68,811	12,04,442	11,95,119	4,17,218	3,47,453	3,64,489	5,83,103	4,98,808
Western China . .	15,77,642	28,97,351	13,33,313	11,86,780	13,13,717	28,22,087	39,53,587	30,39,984	33,17,546	36,77,885
Shan States . .	65,89,712	61,44,271	68,17,745	87,02,420	97,13,764	83,91,367	78,09,082	73,35,867	68,91,525	90,64,237
Siam . . .	20,09,718	28,42,104	21,84,016	40,36,434	36,18,754	14,95,175	13,22,169	8,93,406	11,55,216	4,47,188
Karen-ni . . .	25,57,381	20,24,948	24,30,090	31,52,774	25,04,367	1,50,790	1,33,411	1,35,191	1,33,684	10,71,729
Total	6,41,48,898	6,89,94,079	6,14,20,422	7,02,87,433	7,06,00,314	5,42,61,723	6,02,61,390	5,29,37,593	5,37,07,076	6,15,05,629

N.B.—Figures relate to merchandise only.

TABLE VII

IMPORTS OF PRINCIPAL ARTICLES INTO BRITISH PROVINCES AND NATIVE STATES FROM BRITISH PROVINCES, NATIVE STATES, AND CHIEF SEAPORTS IN 1899–1900 AND 1904–5

ARTICLES.	QUANTITY IN TONS.	
	1899–1900.	1904–5.
Coal and Coke	1,560,504	1,920,259
Cotton—Twist and Yarn, European	22,899	21,998
" " " Indian	34,615	43,146
" Piece-goods, European	130,045	158,828
" " Indian	34,765	40,546
Gram and Pulse	609,409	361,047
Jowār and Bājra	325,339	195,620
Rice in the Husk	172,657	153,132
Rice not in the Husk	730,443	307,623
Wheat	275,080	83,517
Jute—Gunny-bags and Cloth	95,285	127,660
Iron and Steel	182,620	325,236
Other Metals	39,592	52,768
Kerosene	113,001	183,544
Dried Fruits and Nuts	71,523	85,717
Ghī	13,862	12,987
Railway Materials	403,230	504,006
Salt	720,877	808,261
Betel-nuts	39,791	54,684
Other Spices	56,611	62,305
Sugar	404,724	580,942
Tobacco	41,910	45,346
TOTAL	6,078,782	6,129,172

TABLE VIII. TRADE OF THE PROVINCIAL BLOCKS, 1903–4

(In Lakhs of Rupees)

PROVINCES AND STATES.	EXPORTS TO			IMPORTS FROM			TOTAL.
	British Provinces.	Native States.	Port Towns.	British Provinces.	Native States.	Port Towns.	
Madras	1,41	2,29	14,29	1,02	1,60	10,48	31,09
Bombay	3,66	2,42	15,26	2,21	2,00	8,99	34,54
Sind	59	11	3,16	66	13	2,51	7,16
Bengal	6,45	25	40,26	8,18	17	24,05	79,36
United Provinces	8,04	2,21	14,95	7,91	2,19	9,28	44,58
Punjab	3,55	99	10,12	4,85	48	9,77	29,76
Central Provinces	3,06	35	5,54	2,44	48	2,85	14,72
Berār	1,13	3	5,43	1,77	9	1,61	10,06
Assam	2,50	...	5,15	1,34	...	2,39	11,38
Rājputāna and Central India*	4,08	...	6,07	5,20	...	2,60	17,95
Hyderābād *	1,31	...	3,39	1,81	...	1,46	7,97
	1,74	...	1,33	1,65	...	1,88	6,60
TOTAL	37,52	8,65	1,24,95	39,04	7,14	77,87	2,95,17

* Trade between Native States is not registered.

TABLE IX

Trade of Ports with the Provincial Blocks, 1903–4

(In Lakhs of Rupees)

Exports from and Imports into	Calcutta.		Bombay Port.		Madras Ports.		Karachi.		Total.	
	Exports.	Imports.	Exports.	Imports.	Exports.	Imports.	Exports.	Imports.	Exports.	Imports.
Bengal . . .	40,14	23,91	6	10	6	4	...	...	40,26	24,05
United Provinces .	10,66	6,28	3,50	2,80	8	...	71	20	14,95	9,28
Bombay . .	1	2	14,99	8,91	25	6	1	...	15,26	8,99
Madras . . .	15	9	34	50	13,80	9,89	...	...	14,29	10,48
Punjab . . .	73	1,73	1,28	2,37	10	1	8,01	5,66	10,12	9,77
Rājputāna and Central India . .	48	19	5,41	2,35	1	2	17	4	6,07	2,60
Central Provinces .	41	33	5,08	2,51	5	1	...	...	5,54	2,85
Assam . . .	5,15	2,39	...	...	...	...	...	...	5,15	2,39
Berār . . .	2	2	5,38	1,58	3	1	...	...	5,43	1,61
Hyderābād . .	...	1	2,36	1,19	1,03	26	...	...	3,39	1,46
Sind . . .	...	...	...	1	...	...	3,16	2,50	3,16	2,51
Mysore . .	...	...	11	42	1,22	1,46	...	...	1,33	1,88
Total	57,75	34,97	38,51	22,74	16,63	11,76	12,06	8,40	1,24,95	77,87

TABLE X

Incidence of the Value of Trade, in Rupees, on each Acre of Cultivation and each Head of Population, 1903–4

Provinces and States.	Total trade per cropped acre.	Incidence of the Value, per Head of Population, of			Net exports per head.
		Exports.	Imports.	Total.	
Bengal	15·8	6·0	4·1	10·1	1·9
United Provinces .	12·5	5·2	4·0	9·2	1·2
Bombay (with Baroda)	14·5	8·9	5·5	14·4	3·4
Madras (with Coorg).	11·5	4·2	3·1	7·3	1·1
Punjab (with Frontier Province) . .	12·0	5·5	5·6	11·1	−0·1
Rājputāna and Central India . . .	...	5·5	4·3	9·8	1·2
Central Provinces .	8·7	7·5	4·9	12·4	2·6
Assam . . .	22·4	12·5	6·1	18·6	6·4
Berār . . .	13·9	24·0	12·6	36·6	11·4
Hyderābād . .	...	4·2	2·9	7·1	1·3
Sind	22·4	11·3	9·7	21·0	1·6
Mysore . . .	10·8	5·5	6·4	11·9	−0·9

CHAPTER VI

IRRIGATION AND NAVIGATION

Irrigation

Preliminary.

IRRIGATION works, the object of which is the artificial application of water to the land for purposes of agriculture as a means of supplementing the natural rainfall, although almost unknown in Northern Europe, have existed in India, as in most other Eastern countries, from time immemorial. This is a natural result of the conditions of climate. India contains large tracts, such as the deserts of Sind and the South-western Punjab, which are practically rainless, and in which cultivation without irrigation is impossible. There are others, such as the Deccan plateau, where cultivation is exceedingly precarious, owing to the great irregularity of the rainfall and the long intervals during which crops may be exposed to the fierce heat of the sun, and to dry and scorching winds. In such regions there may be an almost complete failure of crops in a year of short or badly distributed rainfall, and a succession of two or more unfavourable seasons might result in famine. In other more favoured tracts, such as the Himālayan submontane districts, a serious failure of the rainfall is seldom or never known, yet here also irrigation works, which are usually of a simple kind such as can be constructed by the people themselves, are of the greatest value in improving the out-turn of the crops. Lastly, there are districts which ordinarily receive so copious a rainfall that rice is almost the only crop grown; but for this water is required at certain critical periods when there may be a break in the rains, and a full harvest can only be secured by irrigation[1]. In general it may be said that the security of the harvest depends on the existence of some form of irrigation in almost all parts of India, except in tracts such as Eastern Bengal, Assam, or Lower Burma, where the average rainfall does not fall short of 70 inches per annum. As might

[1] For a full account of the rainfall conditions, see Vol. I, chap. iii, 'Meteorology.'

be expected under these conditions, the simpler forms of irrigation works have been limited in number and capacity only by the resources and engineering skill of the people, by the insecurity of tenure, and by the interruptions caused by invasion or internal dissension. Some of these works were constructed by the former rulers of the country; but it was not until after the establishment of British rule that the larger and more important works, many of which irrigate annually several hundred thousands of acres, were undertaken. As an instance of the magnitude of some of these later works may be mentioned the Chenāb Canal, which irrigates nearly 2,000,000 acres, or about two-fifths of the whole cultivable area of Egypt, with an ordinary discharge of 11,000 cubic feet per second, or about six times that of the Thames at Teddington. 'No similar works in other countries approach in magnitude the irrigation works of India, and no public works of nobler utility have ever been undertaken in the world[1].'

Different types of irrigation works.

Irrigation works may be conveniently divided into three great types: namely, lift, storage, and river works, which are represented by wells, tanks or reservoirs, and canals. In lift-irrigation the water is raised from a lower level to that which will command the area to be irrigated, the raising being effected either by manual labour or by animal or mechanical power. The source of supply is usually the subsoil water into which wells have been sunk, but lift appliances are often erected on the banks of rivers or pools from which water is raised to the lands to be irrigated. Storage works are reservoirs, formed by the construction of dams across drainage lines, for the purpose of storing the supply which passes down after every heavy fall of rain for subsequent use during long breaks in the rains or in seasons of drought. River works consist essentially of canals, drawing their supplies from rivers which are in continuous flow during the whole or the greater portion of the year. In most cases they include a weir, which is constructed across the bed of the river immediately below the off-take of the canal, for the purpose of holding up water to the full supply level of the canal during low stages in the river. The canals are usually graded with a much lower bed-fall than that of the river from which they take off, and, by a suitable alignment, can often be carried out of the river valley on to high land, or even on to the watershed separating the catchment of the river from that of the drainage line lying next to it. The great canals in Northern India, and in the Orissa and

[1] Sir J. Strachey's *India* (1903), p. 222.

Madras deltas, command nearly the whole of the lands lying between the main rivers in the former and the branches or arms of the deltas in the latter. In the Peninsula proper, conditions are less favourable, and the formation of the country prevents canals being taken far out of the river valleys. It must be remembered, too, that some large rivers, such as the Narbadā and the Tāpti, are throughout useless for irrigation, by reason of their deep and often rocky channels.

Overlapping of types.

Although these three types are in themselves as distinct as the sources of supply on which they depend, they sometimes overlap. Lifting appliances are often required to raise water from canals to ground on a higher level, and the cultivation under some tanks and canals can only be matured by the use of supplemental wells. Large storage works are incomplete without a network of distributing channels; and canals taking off from rivers in which the supply is uncertain and intermittent require storage works which may be constructed either at some distance up-stream from the head-works, in the valley of the main river or of a tributary, or as 'tail tanks' at suitable points on the line of the canal itself. But although in particular cases all three classes may be found in combination, each is so distinct from the others that it deserves separate consideration.

Area irrigated from wells.

An important point in connexion with pure lift-irrigation works is that they have been constructed by private enterprise on the part of the owners or cultivators of the soil. The works are all of a petty character, and irrigate an area which may be as low as one acre and seldom exceeds twenty. Such works cannot conveniently be owned or maintained by the state, which can do no more than encourage their construction by agricultural loans and by liberal rules in the matter of land-revenue assessment. But although these works are small and have cost the state nothing, their importance in the aggregate is very great. Taking the average area annually irrigated from works of all classes in British India at 44,000,000 acres, it is found that nearly 13,000,000 acres, or about 30 per cent., are irrigated from wells. Well-cultivation is moreover of the highest order; and it may be safely estimated that the produce annually raised from pure lift-irrigation is, in value, considerably more than a third of the out-turn from irrigation works of all kinds. The most favourable conditions for well-irrigation are found in the alluvial plains of Northern India, the subsoil of which contains an inexhaustible supply of water. Out of the 13,000,000 acres thus irrigated more than 9,500,000 are in the United Provinces and the Punjab, and about 2,750,000 in the

Madras and Bombay Presidencies. In other Provinces well-cultivation is inconsiderable, being confined to garden or other special crops.

Permanent and temporary wells.

When the spring level is near the natural surface and the soil is fairly stiff, a well may consist of nothing more than a hole in the ground over which the appropriate lifting appliances are erected. These wells, which usually fall in or are abandoned after one or two years' working, are called 'temporary' wells, to distinguish them from 'permanent' or masonry-lined wells, which, if solidly built, may last for an indefinite period. In some parts there is an intermediate type, in which the well is lined with a wooden cylinder or with brushwood or wicker-work. In the United Provinces less than one-fourth of the total number of wells are permanent; and both here and in the Punjab the number of temporary wells fluctuates greatly from year to year according to the season, being greatest in years of drought. The cost of a well varies from a few rupees for a temporary, to over Rs. 1,000 for a deep and permanent structure, but the average cost of a permanent well is between Rs. 300 and Rs. 600 according to size and depth. In the Punjab, where the wells are mainly permanent, the average area irrigated per well is 12 acres; but in the United Provinces, where so large a proportion of the wells are temporary, irrigating only 1 or 2 acres, the average area per well is not more than 4 acres. In Southern India the average area is between 2 and 3 acres; but here well-irrigation is, as a rule, applied only to the most valuable class of crops, which require frequent waterings.

Lifting appliances.

The wells now in use throughout India, and the lifting appliances employed, do not differ materially from those in use in former times. The water is almost invariably raised either by manual labour or by bullocks. For the former the favourite contrivance is the well-known *picottah*, in which the water is drawn up by means of a bucket suspended by a rope to the end of a long pole, which is pivoted near the other end to a post so as to revolve through a vertical plane. The shorter end is weighted, so as nearly to counterbalance the weight of the longer arm and the full bucket. The bucket is lowered by the man in charge, who draws the long end of the lever by a pull at the rope, or in some cases, as in Southern India, by running up and down the pole. This contrivance is seldom used for lifts of more than 15 feet, and for very small lifts (of 4 or 5 feet) other simple appliances are used. For lifts of over 15 feet bullock-power is almost invariably employed, and

is often used even for lower lifts. The most common contrivance, which is to be found all over India except in some parts of the Punjab, is the *mot*, which consists of a large leather bag, holding from 30 to 40 gallons of water, fastened to one end of a rope which passes over a pulley overhanging the well. When the bag has been lowered the other end of the rope is attached to a pair of bullocks, who then walk down a ramp of a length approximately equal to the depth of the well. When the bullocks arrive at the end of the ramp the bag has been drawn up to the top of the well, and its contents are emptied into a trough or sump, generally by a man who stands by, but sometimes by a self-acting mechanical arrangement. The rope is then detached from the bullocks, the bag is lowered, and the bullocks return without a load to the top of the ramp, when the operation is repeated. In some parts the rope is not detached and the bullocks walk backwards up the ramp, as the empty bag descends. The alternative to the *mot* is the Persian wheel, which is used extensively in the Punjab. This consists of an endless chain of waterpots passing over a vertical wheel erected over the top of the well, and rotated by means of rough wooden gearing which is worked by a pair of bullocks walking round a circular track. When bullock-power is used water is sometimes lifted for purposes of irrigation as much as 60 feet, but ordinarily the lift seldom exceeds 40. The use of any form of purely mechanical motive power is practically unknown in India. A few isolated attempts have been recently made by private owners to use oil engines, and a project is under consideration to irrigate about 50,000 acres from the Kistna river in Madras by similar means. But even if these should prove successful the practice is not likely to be extensively followed by small cultivators.

Means of promoting the extension of well-irrigation.

Wells play such an important part in the agricultural system of India, and are of such great protective value, that the extension of this form of irrigation must be regarded as highly desirable. There are, however, obvious limits to such extension, even in tracts where conditions of soil, climate, and spring level are favourable. The first cost of a well is only one of the factors to be considered, for its subsequent working requires a considerable amount of capital and very careful husbandry. The extension of well-cultivation must, therefore, always be gradual, and although it may be effectively encouraged it cannot be forced. The encouragement hitherto afforded by the state for the construction of wells and other works of agricultural improvement has been of two kinds—a system

of agricultural advances known as *takāvi*, and a permanent or temporary exemption of the lands depending on the well from any enhancement of land revenue as a consequence of the improvements. *Takāvi* advances are made freely to approved applicants, the general rate of interest being 6¼ per cent., except in Madras and Bombay, where it is only 5 per cent. Recovery is made by instalments extending over periods varying from seven to thirty years. During the ten years ending 1900–1, as much as 625 lakhs was thus advanced by Government, 348 lakhs as agricultural loans, and 277 lakhs for the specific purpose of land improvement. In the Madras and Bombay Presidencies, ryots who construct wells or other works of agricultural improvement are exempted from any future enhancement of land-revenue assessment on the ground of the increase in the agricultural value of their land due to the improvements. In other Provinces the exemption lasts for specific periods, the term being generally long enough for the owner to recoup the capital outlay incurred in the construction of the work.

Extension of well-irrigation during recent years.

It is for many reasons very difficult to compare the area irrigated from wells at the present day (1904) with that irrigated as recently as twenty-five years ago. The Irrigation Commission of 1901–3 reported that in the four Provinces in which well-irrigation is most extensively practised—namely, the United Provinces, the Punjab, Bombay, and Madras—the increase in the number of permanent wells during the decade ending 1900 amounted to 11, 25, 33, and 44 per cent. respectively; but it seems certain that the increase in the total area irrigated from wells, in the Northern Provinces at any rate, has not been in any way proportional to these figures. This may be due partly to the imperfection of the earlier statistics, partly to the substitution of permanent for temporary wells, and partly to a reduction in the areas irrigated from old wells in tracts where canal-irrigation has been introduced. The Famine Commission of 1880 estimated the area irrigated from wells in 1876–7 at 5,794,000 acres in the United Provinces, and 3,176,000 acres in the Punjab. The Irrigation Commission of 1901–3 found that during the years 1900–2 the area irrigated from wells in the former Province varied from 4,544,000 to 6,122,000 acres, and in the latter from 3,018,000 to 4,155,000 acres. The Famine Commission of 1880 gave no details of well-irrigation in Bombay; but stated that the number of private wells in ryotwāri lands in Madras was believed to be about 375,000, and, on the assumption that the

average area to each well would be about 5 acres, estimated the total area served at 1,800,000 acres. This assumption was probably much too high, for the Irrigation Commission of 1901–3 reported that the number of permanent wells in 1900–1 (excluding mere supplemental wells used on tank-irrigated lands) amounted to 522,300, irrigating about 1,680,000 acres, or not more than 3·2 acres to each well. In this Presidency there appears to have been a material increase not only in the number of wells, but also in the well irrigated area.

Storage works.

Tanks or storage works are of all sizes, ranging from the great lakes formed by the construction of high dams across the beds of large but irregularly flowing rivers, such as Lakes Fife and Whiting in the Bombay Deccan, and the Periyār lake in Travancore, in which are impounded from 4,000,000,000 to 6,500,000,000 cubic feet of water, to the small village tanks to be found throughout Southern India, many of which irrigate less than 10 acres. Any general extension of large works of this description is of course limited by the cost of construction and the loss of supply by evaporation. The idea of forming reservoirs in the beds or valleys of streams which are in flow only for a few weeks or months in the year, must have presented itself to the rulers of the country or to the occupiers of the soil at a very early stage in Indian civilization, at any rate in those parts of the country where the conditions were most favourable; and in such tracts tanks of great antiquity bear witness to the readiness of former rulers to encourage the construction of works of this kind. Some of these works, such as the Chembrambākam and Cumbum tanks in Madras, are of great size, holding from 3,000,000,000 to 4,000,000,000 cubic feet, and with water-spreads of over nine square miles. There are remains of other works of even greater size, such as the Madag tank in the Dhārwār District of Bombay, which have failed or been abandoned. The inscriptions on two large tanks in the Chingleput District of Madras, which still irrigate from 2,000 to 4,000 acres, are said to be more than 1,100 years old. In Upper Burma there are many tanks constructed centuries ago, of which that at Meiktila is the most important. The celebrated lake at Udaipur (Rājputāna), which is said to be the largest in India, is not utilized for irrigation; but of the many old tanks in Rājputāna and Central India some are still so used, although the majority have been abandoned, or no longer hold water. In the Native States of Mysore and Hyderābād, tank-irrigation has been very highly developed. The area irrigated from

large tanks is, however, small in proportion to that dependent on smaller works, most of which were probably constructed originally by the owners or occupiers of the lands protected, with but little assistance from their rulers. The most notable example of these is to be found in the smaller irrigation works in Madras. It is estimated that there are no less than 40,000 of these works in the ryotwāri tracts of that Presidency, of which less than 3,500 irrigate more than 200 acres, while many serve less than 10 acres. The former are cared for by the Public Works Department; more than 31,000 Minor works are in charge of revenue officers; and about 5,000 are small private works. The average area irrigated from the works controlled by Government amounts to more than 3,000,000 acres, or about as much as the entire area irrigated from all the great canals and larger irrigation works in the Province. These petty works include a certain number of small canals, but are mainly tanks or storage works. Tanks abound also in the zamīndāri estates of this Presidency, in which it is estimated that about 2,500,000 acres are irrigated, of which 2,000,000 are dependent on storage works, and the balance on wells and river channels. No approach to these figures is made in other Provinces; but, excluding well areas, nearly two-thirds of the irrigation in the Gujarāt, Deccan, and Carnatic Districts of Bombay depends upon small storage works, and there are 50,000 small private tanks in the Central Provinces, which are said to be capable of irrigating from 150,000 to 650,000 acres, according to the season, being almost the only form of irrigation in that Province, as the area under wells is there inconsiderable. Tank-irrigation is practically unknown in the Punjab and in Sind, but is to be found in some form or other in all other Provinces, including Burma. The *jhīls* or natural depressions scattered at intervals over the flat alluvial plains of the United Provinces, most of which are privately owned, irrigate about 2,000,000 acres.

Method of construction. Storage works consist eventually of four parts. The dam, which may vary in height from 15 to 160 feet, may be constructed of earth, concrete, or masonry, but earthwork is seldom relied on for greater heights than 80 feet. When concrete or masonry is used, sound rock foundations are essential, and many sites otherwise eligible must be rejected when this cannot be found. The submerged area may, when full, have a water surface of many square miles, and here again sites otherwise eligible must be rejected on account of the large areas of cultivable land which would be thrown

out of cultivation or the high compensation that would have to be paid. The outlet and distributing channels, through which water is drawn off from the reservoir and carried to the lands to be irrigated, often form a very expensive item. Lastly, there is the waste-weir or escape, through which flood-waters must be passed at times of abnormally heavy rainfall in such a way as not to imperil the safety of the work. The total cost of a storage work varies enormously according to the site. The two largest works executed by Government, the Nīra Canal and the Periyār Project, have each cost about Rs. 1,300 per 1,000,000 cubic feet in a full lake. Although these and many other large storage works have been constructed by the British Government, tank-irrigation is essentially a product of native rule, and almost the whole of the tank-irrigated area is from old native works, the maintenance of which is now undertaken in whole or in part by the state. These works are mainly confined to the crystalline and sandstone formations, which occupy the whole of the Indian Peninsula between the Deccan trap area and the narrow strip of alluvium on the coast. The formation of the country in this area favours the construction of tanks, which form the principal means of irrigation. The area comprises the greater part of the Madras Presidency, nearly the whole of Mysore, half of Hyderābād, nearly two-thirds of the Central Provinces, the Baghelkhand States of Central India, the eastern half of Rājputāna, and portions of the United Provinces and of the Orissa and Chotā Nāgpur Divisions in Bengal.

Storage works maintained or controlled by the state.

It has already been stated that wells are constructed and maintained solely by private enterprise. This is also true of the smaller forms of tank, the petty works which serve a single holding or irrigate little more than 10 acres; but the largest works, which impound several thousand million cubic feet of water and submerge many square miles of country, could only have been constructed by the rulers of the country, and have always been maintained as state irrigation works. Between these extremes are the moderately sized tanks, capable of irrigating from 10 to 300 or 400 acres annually. Many of them appear to have been originally constructed by private or communal enterprise, but the state is so interested in the land revenue dependent on them that it has gradually undertaken their control or management and contributes largely to their improvement and up-keep. Thus it happens that in the ryotwāri tracts of Madras and Bombay all but the smallest tanks are controlled by Government. In the Central Pro-

vinces, on the other hand, the Government has no concern in the management of the *mālguzār's* tanks; and in the United Provinces, where the greater part of the irrigation recorded as from tanks is effected from the *jhīls* above mentioned, it maintains only the large tanks which have always been recognized as state works. In Ajmer-Merwāra and in Upper Burma most of the tanks are kept up by Government.

Area irrigated by tanks.

The average area recorded as irrigated from tanks in British India is about 8,000,000 acres, but the supply to many of the works is very precarious, and is apt to fail in years of extreme drought. This figure does not include the large areas over which rain-water is held up for some time after every fall by means of field embankments, such as are to be found under different names in Bengal, Bundelkhand, the Central Provinces, Gujarāt, and the Bombay Deccan. The agricultural value of these temporary storage works is considerable, but the areas protected by them are not usually recorded or regarded as tank-irrigation.

Small private canals.

The third and most important class of irrigation works, viz. river works or canals, are generally of such magnitude, and affect so many different interests, that they could only have been constructed, and can only be efficiently maintained, by the state. There are, however, a certain number of petty works of this class which have been constructed and are still maintained by private enterprise, with occasional assistance in some Districts from Local funds. In the Punjab nearly 1,000,000 acres are irrigated annually from works of this class, of which more than 100,000 acres are dependent on inundation canals made by the people, but now under the control of the District Boards. Nearly 100,000 acres are irrigated from canals of the same kind belonging to private landowners, and about 800,000 acres receive irrigation from hill streams, or from *jhīls* from which water is diverted by means of simple works and small channels that have been constructed by communal effort. In the United Provinces about 750,000 acres are irrigated from private canals, of which the most important are the works constructed in the Bastī and Gorakhpur Districts by two English landowners, which irrigate areas of 40,000 and 15,000 acres of rice and *rabi* crops within their respective estates. In the permanently settled Districts of Bengal, and especially in Bihār, there are a great number of small canals, called *pains*, by which water is diverted from the innumerable streams which traverse the country and is conducted directly into the rice-fields or stored in small reservoirs (*ahars*) which

have been formed by field embankments, for use during breaks in the rains. The total area protected in Bengal by means of these *pains* and *ahars* is estimated at nearly 5,000,000 acres. In Madras about 336,000 acres are irrigated annually from private canals, including the spring channels which are made in the beds of streams during the dry season, of which nearly nine-tenths are in *zamīndāri* estates. The Minor works under Government control in this Province also include many small river channels. In the Bombay Deccan and in Gujarāt there are many works of the same kind, most of which are under Government management. It is difficult to state with accuracy the areas irrigated throughout India from these small canals, as in the Provincial returns some are included under the head 'Canals,' others under 'Tanks' (which are often associated with them), and others, as in Bengal and the United Provinces, under 'Other sources'; but the total area protected by private canals is probably between 7,000,000 and 8,000,000 acres. Many of these works are, however, apt to fail in years of prolonged or severe drought.

Perennial and inundation canals.

We now proceed to consider the great canals which have been constructed and are maintained by the state, most of which extend over very wide areas, irrigate many thousand acres, and comprise hundreds or thousands of miles of distributary channels. These works may be divided into two classes, perennial and inundation canals. Strictly speaking, a perennial canal is one which has an assured supply of water all the year round; but this generally involves the construction of a weir or 'anicut' across the bed of the river, to hold up the low supplies and divert the whole, or as much as may be needed, into the canal. This is not, indeed, always necessary, for the head-works of the Swāt River Canal in Peshāwar District (Frontier Province) are so favourably situated that a perennial supply can be obtained without the assistance of a weir; which is also considered unnecessary for the Tribenī Canal now under construction in the Champāran District of Bengal. On the other hand, the river supply may fail in a river across which a weir has been constructed. As a general rule, however, a canal which takes off from above a properly constructed weir is assured of a fairly continuous supply during the season when water is required, and it is at any rate possible to utilize every drop of water that comes down, however low the state of the river. The term 'perennial' is therefore generally applied to a canal which can draw off a constant supply without the assistance of a weir, or which is provided

with a weir which will render the supply to the canal dependent only on the quantity of water in the river and not on its surface level; while if the supply is not sufficiently continuous for the purposes required, it can generally be rendered so by the construction of storage works. Inundation canals are simple channels taking off from the banks of a river at a level which is generally considerably higher than the ordinary low-water level of the stream. Water flows into these cuts during the flood season, and they remain in flow until the river falls below the level of their beds, which is generally 2 or 3 feet higher at the end than at the beginning of the season, owing to silt deposits, which have to be cleared during the low-river season. The most important inundation canals are to be found in the Punjab and Sind, i.e. in the valley of the Indus and its tributaries. They are in flow, generally, from the beginning of May until the end of September, although the supplies fluctuate greatly during this period with the surface levels in the river. Cultivation, which is practically impossible without irrigation in the rainless tracts they serve, has adapted itself to these conditions. The average area irrigated from the inundation canals under Government amounts to about 3,500,000 acres, of which 2,500,000 are in Sind. In addition, about 1,000,000 acres are irrigated by the Bahāwalpur State Canals and by the District and private canals in the Punjab, 75 per cent. of this area being in the Native State of Bahāwalpur.

Canals made by former rulers of the country.

Although the present system of large irrigation works has been almost entirely constructed by the British Government, examples are not wanting of old river works undertaken by former rulers of the country. Irrigation was carried out on a large scale in the Cauvery delta, the supply being maintained by means of a weir, known as the Grand Anicut, which is said to have been constructed over 1,500 years ago. This is the work which Sir Arthur Cotton strengthened and improved in 1835–6, and the success of which encouraged him to propose the great Godāvari works which he afterwards constructed. Most of the weirs on the Tungabhadra, above which the present Tungabhadra channels draw their supplies, were constructed by the Hindu monarch, Krishna Rāya, at the beginning of the sixteenth century. In Northern India the Muhammadans appear to have made frequent attempts to utilize the water of the river Jumna. In the middle of the fourteenth century Fīroz Shāh, Tughlak, constructed a canal on the right bank of the river, 150 miles in length, for the irrigation of his domains in Hissār. This canal, which had silted up, was reopened in

Akbar's reign, and a branch was made to Delhi in the reign of Shāh Jahān; but during the decline of the Mughal dynasty both canals gradually silted up. A canal was also made on the eastern bank of the Jumna at the beginning of the eighteenth century, but appears to have likewise been abandoned, although it is said to have carried water to below Sahāranpur. These canals were subsequently cleared and reopened by the British Government, have since been realigned, extended, and improved, and are now first-class irrigation works known as the Western and Eastern Jumna Canals. In the Punjab the small Hasli Canal had been made by former rulers, for the purpose of carrying water from the river Rāvi to Lahore and Amritsar, on very much the same alignment as the present Bāri Doāb Canal. The simple system of irrigation by inundation canals appears to have been practised from time immemorial in Sind and the Punjab; and many of the existing canals of this class in Multān, Muzaffargarh, and Dera Ghāzi Khān were brought to a fair state of efficiency under the more energetic Pathān and Sikh governors of these Districts, and were in operation at the time of annexation, but have since been considerably developed.

Attempts to construct large irrigation works by private enterprise.

Although the earliest results attained by direct Government agency on the Cauvery, Godāvari, and Jumna works were sufficiently encouraging, the East India Company was reluctant to commit itself to any extensive scheme of state irrigation works. Funds for such works as were sanctioned were provided out of revenue, and the policy of a productive public works loan had not then been inaugurated. It was at first thought that the construction of large irrigation works, like that of railways, could be most advantageously entrusted to private enterprise. In 1857 the Court of Directors asked for proposals for new irrigation works in Madras, to be constructed by this means. The Madras Government, under the advice of Sir Arthur Cotton, proposed a great scheme, known as the Tungabhadra project, for the irrigation of large portions of the Bellary, Kurnool, Cuddapah, and Nellore Districts; and the Madras Irrigation Company was eventually formed for its prosecution, with a Government guarantee. Operations were limited at first to the construction of that part of the general scheme known as the Kurnool-Cuddapah Canal, which was completed by the company; but the capital cost had greatly exceeded the original estimates, the financial prospects of the project were very unfavourable, and the company was in such

difficulties that the Government was compelled to take over the work in 1882.

In pursuance of the same policy the East India Irrigation and Canal Company was formed in 1860 for the purpose of carrying out the Orissa Canal Project, also proposed by Sir Arthur Cotton. Here, again, it was found that the capital cost of the works had been greatly under-estimated, while a very exaggerated estimate had been formed of the revenue which would be derivable from the work. The company was unable to raise the necessary funds for completing the undertaking, and in 1869 Government purchased the works and the company ceased to exist.

Construction of new irrigation works by the state. Productive and protective Major works.

The selection of these two projects for execution by private companies was unfortunate, for experience has since shown that neither of them is ever likely to prove a directly remunerative undertaking. But it was soon recognized that, even in more favourable circumstances, the construction and control of irrigation works of this class could not conveniently be entrusted to private enterprise; and, under the viceroyalty of Lord Lawrence, a new policy was initiated under which irrigation works that gave a fair promise of proving directly remunerative were to be constructed by the state from loan funds, as 'productive' public works. From that time the construction and extension of works of this class by means of borrowed money has been actively and systematically proceeded with, the total capital outlay recorded to the end of 1902–3 on works classed as 'productive' amounting to about 38 crores of rupees. State expenditure has not, however, been confined to works which were considered likely to prove remunerative at the time they were undertaken, although loan funds have hitherto been applied only to works of this class. In accordance with the recommendation of the Famine Commission of 1880, several large works which gave little promise of proving directly remunerative have been undertaken on the ground of their value as a protection against famine. The capital cost of these undertakings, which are called 'protective' works, has been met from the Famine Insurance Grant[1], the total expenditure thereon recorded to the end of 1902–3 amounting to more than 2½ crores of rupees. These two classes of works, productive and protective together, make up what are known in irrigation accounts as Major works. They are works which have been wholly constructed or reconstructed by the British Government, and for which regular capital, revenue, and interest

[1] See Vol. IV, chap. vi, Finance.

accounts are kept, which exhibit the financial results attained as fully as is usual in other commercial undertakings.

It should be added that Major works do not consist entirely of river works or canals. The irrigation works in the Punjab, Sind, the United Provinces, and Bengal are all of this type; but those in Madras and the Bombay Deccan include some purely storage works, and some canals, such as the Periyār Project and the Nīra Canal, with which large storage works are combined.

Minor works for which capital accounts have been opened.

Considerable expenditure has also been incurred by the British Government on works which do not fall under the Major category. Reference has already been made to those old or indigenous irrigation works the maintenance of which, as Minor works, is undertaken by Government. The more important of these have, however, been not only maintained, but extended and improved, at the cost of the state. The cost of such improvements has been recorded as capital expenditure, although the funds have been provided from general revenues. There are also a few new works, generally of small size, the cost of which has been met in the same way. Both kinds of works are classified as 'Minor works for which capital accounts are kept.' The total capital expenditure on works of this class to the end of 1902–3 amounted to 329 lakhs of rupees, while the area irrigated from them is nearly 2,000,000 acres. The aggregate capital outlay to the end of 1902–3 on Major and Minor works together amounted to nearly 43 crores, and the area irrigated from them in that year was about 14,000,000 acres. The annual value of the crops raised by the works for which capital accounts are kept is estimated at 40 crores, or about 88 per cent. of the capital outlay thereon.

Total outlay on irrigation, and results.

Detailed statement of Major works.

Details for each Major work, and, as a whole, for the Minor works for which capital accounts are kept, are given in the table on pp. 331, 332 for each Province. The figures are given for the year 1902–3, and may be regarded as fairly normal in the present stage of development of the irrigation system.

It will be seen that, although many individual works, especially those in Bengal and Bombay, show an insignificant return on the capital outlay, the Major works as a whole have proved a very profitable investment, the net revenue yielding a return of nearly 7 per cent., while the Minor works have been hardly less profitable. A brief description will now be given of the principal state irrigation works in each Province.

Punjab and Frontier Province

No Province presents greater facilities for irrigation than the Punjab with its snow-fed rivers and level plains. The

PROVINCE.	Name of Work.	Capital outlay to end of 1902-3, in lakhs of rupees.	Area irrigated during 1902-3, in acres.	Percentage of net revenue for 1902-3 to capital outlay.
Punjab	*Major Works.*			
	Western Jumna Canal (including Patiāla section)	1,84	595,229	7·7
	Bāri Doāb Canal	1,96	893,862	12·9
	Sirhind Canal (including Native States)	3,87	1,112,425	4·4
	Upper Sutlej (including Lower Sohāg and Pāra Canal)	17	233,887	6·3
	Chenāb Canal	2,75	1,829,169	21·3
	Sidhnai Canal	13	60,791	3·9
	Jhelum Canal	1,15	138,911	-1.0
	TOTAL Major Works	11,87	4,864,274	9·7
	3 Minor Works	13	235,087	8.0
	TOTAL	12,00	5,099,361	..
North-West Frontier Province.	Swāt River Canal (Major Work)	42	173,772	10.6
	1 Minor Work	5	..	23·0
	TOTAL	47	173,772	..
Sind	*Major Works.*			
	Desert Canal	26	187,061	3·7
	Unar Wah Canal	6	64,350	11·6
	Begāri Canal	17	225,612	15·8
	Eastern Nāra Works	64	256,938	6.8
	Jāmrao Canal	83	269,358	3·8
	Dad Canal	21	60,256	-1·2
	Mahi Wah Project	10	8,426	-2·0
	TOTAL Major Works	2,27	1,072,001	5·0
	8 Minor Works	42	794,530	20·5
	TOTAL	2,69	1,866,531	..
Bombay (Deccan and Gujarāt).	*Major Works.*			
	Hāthmathi Canal	5	287	-1·2
	Lower Pānjhra River Works	5	2,503	1·5
	Kādva River Works	8	2,775	0·2
	Lākh Canal	4	1,206	-0·3
	Muthā Canals	68	8,101	2·4
	Ekrūk Tank	13	2,030	0·5
	Kistna Canal	8	5,963	3·7
	Mhasvād Tank	21	4,075	0·02
	Nīra Canal	57	35,102	3·1
	Shetphal Tank	7	216	0·02
	TOTAL Major Works	1,96	62,258	1·9
	26 Minor Works	76	38,237	0·4
	TOTAL	2,72	100,495	..

PROVINCE.	Name of Work.	Capital outlay to end of 1902-3, in lakhs of rupees.	Area irrigated during 1902-3, in acres.	Percentage of net revenue for 1902-3 to capital outlay.
Madras	*Major Works.*			
	Godāvari Delta System	1,34	810,634	18·4
	Kistna Delta System	1,44	627,850	15·8
	Penner River Canals	63	163,641	5·0
	Cauvery Delta System	31	982,356	28·5
	Srīvaikuntam Anicut System	15	44,526	6·1
	Kurnool-Cuddapah Canal	2,17	60,154	0·5
	Barūr Tank	4	5,325	1·4
	Periyār Project	90	154,068	3·6
	Rushikulya Project	49	92,399	0·6
	TOTAL Major Works	7,47	2,940,953	8·7
	28 Minor Works	1,05	584,081	7·0
	TOTAL	8,52	3,525,034	..
Bengal	*Major Works.*			
	Orissa Project	2,65	224,779	0·05
	Midnapore Canal	85	87,464	0·8
	Son Project	2,67	483,567	3·3
	TOTAL Major Works	6,17	795,810	1·6
	1 Minor Work	7	..	−0·4
	TOTAL	6,24	795,810	..
United Provinces.	*Major Works.*			
	Ganges Canal	3,04	871,862	10·5
	Lower Ganges Canal (including Fatehpur Branch)	3,98	849,061	3·8
	Agra Canal	99	236,721	6·2
	Eastern Jumna Canal	43	284,079	25·0
	Betwā Canal	45	64,457	−0·5
	TOTAL Major Works	8,89	2,306,180	7·0
	4 Minor Works	31	137,375	2·8
	TOTAL	9,20	2,443,555	..
Ajmer-Merwāra	Minor Works in 3 subdivisions	31	26,199	1·2
Baluchistān	2 Minor Works	17	2,939	−0·6
Burma	Mandalay Canal (Major Work)	47	7,223	−0·2
	GRAND TOTAL Major Works	39,52	12,222,471	6·9
	GRAND TOTAL Minor Works (with Capital Accounts)	3,27	1,818,448	6·0
	GRAND TOTAL Major and Minor Works	42,79	14,040,919	..

Major works.

restoration of Fīroz Shāh's Canal on the west bank of the Jumna was commenced during the administration of the Marquis of Hastings (1814–23), and the canal was gradually brought into such a state of efficiency that it was capable of irrigating over 500,000 acres in the year 1870. By reason, however, of its original faulty alignment, this canal, although a very profitable work, caused great injury to the country by water-logging, and could not be extended owing to the insecurity of the supply. In 1870 it was decided that the canal should be wholly remodelled; and the greater part of it has since been re-aligned and reconstructed, while new branches have been made, so that in the famine year 1897–8 it irrigated 764,000 acres.

The Bāri Doāb Canal, which takes off from the right bank of the Rāvi at the point where it debouches from the hills, and irrigates large portions of the Gurdāspur, Amritsar, and Lahore Districts, was undertaken almost immediately after the annexation of the Province, and was opened for irrigation in 1860–1, but it has since been greatly enlarged and extended. The Sirhind Canal, which taps the Sutlej at Rūpar, as it emerges from the Siwālik hills, was originally proposed by Sir William Baker in 1841, but the first estimate was only sanctioned in 1870, and the canal was opened by Lord Ripon in 1882. More than one-third of the cost of this canal has been contributed by the three Phulkiān States—Patiāla, Nābha, and Jīnd, which are entitled to a corresponding share of the supply. The canal irrigates large areas in these States, and also in the Farīdkot State and in the British Districts of Ludhiāna and Ferozepore. The Swāt River Canal, in the Peshāwar District of what is now the Frontier Province, is said to have been suggested by Sir Henry Lawrence soon after the annexation of the Punjab, but was first definitely proposed by Sir Henry Durand in December, 1870, and was opened for irrigation in February, 1885.

The Sidhnai, Lower Sohāg and Pāra, and Chenāb Canals were commenced in 1884. The first of these is a small canal for the irrigation of a portion of Multān District, which takes off from a weir constructed on the Rāvi at a short distance above its confluence with the Chenāb. The Lower Sohāg and Pāra is an inundation canal from the right bank of the Sutlej, and has no weir; it irrigates a portion of Montgomery District, and has recently been grouped with the Upper Sutlej inundation canal, formerly a Minor work. The Chenāb Canal was also originally designed as a small inundation canal, and opened as such in 1887, but in 1889 it was decided

to convert it into a perennial canal of the first magnitude. A weir and head-works across the Chenāb river at Khanki, about 8 miles below Wazīrābād, were completed in 1892. The canal has since been enlarged and extended so as to command the greater portion of the Rechna Doāb, the tract lying between the Chenāb and Rāvi rivers in the Gujrānwāla, Jhang, and Montgomery Districts. Great part of the area commanded by the Sidhnai, Lower Sohāg and Pāra, and Chenāb Canals was uninhabited crown waste, so that the success of the works depended on the introduction of settlers or colonists who would take up and cultivate the land. The first efforts were made on the two smaller canals with encouraging results, and the experience gained was of the utmost value in subsequently carrying out the great scheme for the colonization of the Rechna Doāb. The magnitude of this scheme and the success which has attended it are shown by the fact that up to the end of 1902–3 the area which had been sold or leased to cultivators amounted to 1,750,000 acres; while the population of the colonized tract, which in 1891 was practically non-existent, was returned at 792,000 in the Census of 1901. The colonists were drawn from the agricultural classes in the congested districts of the Province, and are now a thriving and prosperous peasantry. The total area irrigated by the canal in 1902–3 amounted to 1,829,000 acres. The Jhelum Canal was opened in October, 1901. It was commenced in November, 1898, and is at present estimated to cost 144 lakhs and to irrigate annually more than 600,000 acres. It takes off from the right bank of the Jhelum near Rasūl, the site of the battle-field of Chiliānwāla, and will irrigate a portion of Shāhpur District. Here also there is a large area of crown waste into which colonists must be introduced; but there is no reason to doubt that the canal will prove a successful and highly remunerative work.

Punjab inundation canals.

The Minor Punjab works entered in the table include two systems of inundation canals, the Shāhpur and the Dera Ghāzi Khān Canals, for each of which a capital account has been opened[1]. There are, moreover, three other large systems of old inundation canals—the Lower Sutlej, the Lower Chenāb, and the Muzaffargarh Canals—which were constructed under native rulers, but are now maintained as Minor works by Government, although capital accounts are not kept for them, and which together irrigated 815,690 acres in 1902–3. The

[1] Since 1902–3 the Dera Ghāzi Khān Canals have been transferred to the 'Major' head.

total area irrigated annually from state works in the Punjab and the Frontier Province is about 6,000,000 acres.

Scope for extension of irrigation in the Punjab.

Although so much has been done to extend irrigation in the Punjab, the field is by no means exhausted. Apart from all extensions of existing works and many small schemes that may be adopted, two large tracts remain to be brought under irrigation. One of them is known as the Bāri Doāb, including nearly 1,600,000 acres in the Montgomery and Multān Districts, of which about half is crown waste. A detailed project for the irrigation of this tract, by means of a canal taking off from the right bank of the Sutlej immediately below the confluence of the Beās, has been prepared, but has been set aside in favour of an alternative proposal for irrigating the same tract by means of new canals from the Chenāb river, the cold-weather supply of which would be augmented by a feeder from the Jhelum. This canal will command and protect a much larger area than the Sutlej project, and will have the advantage of leaving the supply in the Sutlej available for further extensions of irrigation on the left bank, in British or Bahāwalpur territory. The second tract is the great Sind Sāgar Doāb, which comprises an area of over 5,000,000 acres lying to the south of the Salt Range and bounded by the Indus river on the west, and by the Jhelum and Chenāb on the east. The whole of this country could be commanded by a great canal taking off from the Indus at Kālābāgh; but the work would be very costly, and a great part of the area is so covered with sand-hills that it would be unsuitable for irrigation. It is possible that this scheme, or a modification of it, may be carried out eventually, but it cannot be considered as urgent or as a very promising financial investment. Almost all the Districts of the Punjab contain stretches of inferior soils, impregnated with salt or *reh*; and although it is beyond doubt that some extension, or further deterioration, of these areas has been the result of excessive water-supply, there is also evidence that such lands are not always unsuitable for irrigation, and that they have in some cases been improved or reclaimed by it. Moreover, these stretches are not so numerous or extensive as to render it unprofitable to carry canals through them for the improvement of better soils around or beyond them.

Sind.

Agriculture in Sind, which is an almost rainless tract, is wholly dependent on artificial irrigation, and population is to be found only where the means of irrigation have been provided. Here, as in the Punjab, irrigation has completely altered the face of the country, and has converted barren wastes

into fertile fields of wheat and rice. The works in Sind consist almost entirely of inundation canals from the Indus. The Desert, Unar Wah, and Begāri Canals all take off from the right bank, above Sukkur, and have been practically constructed by the British Government. The Eastern Nāra is a branch from the Indus, which takes off from the left bank, immediately above Sukkur, and discharges into the Rann of Cutch. This branch has been deepened at the head and brought under control, so that it provides a perennial supply to the canals which take off from it. Among these is the recently constructed Jāmrao Canal, which takes off from the Nāra at the lower boundary of the Khaīrpur State and commands a large area of waste land. Colonists are being introduced on the system which has been so successfully followed in the Punjab, and the prospects are promising. The canal was opened in November, 1899, and irrigated more than 269,000 acres in 1902–3. In addition to these Major works, Sind contains several large inundation canals, which are Minor works with capital accounts. Among these the largest and most important is the Fuleli Canal in Hyderābād District, which is navigable and generally in flow all the year round, and is capable of irrigating over 400,000 acres. There are also, as in the Punjab, a number of smaller canals, which are maintained by Government as Minor works, for which no capital accounts are kept, and which together irrigate about 900,000 acres.

In addition to the works mentioned, four small productive works are under construction on the left side of the Indus, and many extensions of existing canals have been proposed. It is estimated that when all these have been completed the total area annually irrigated, which may be taken as averaging about 2,700,000 acres, will be increased by about 20 per cent. The irrigated area fluctuates greatly according to the state of the river, the difference between a very favourable and an unfavourable season being as much as 800,000 acres. In spite of these fluctuations the canals never wholly fail, and are remarkably cheap and profitable works. It has been suggested that the area under irrigation might be greatly extended, and the efficiency of many of the existing canals increased, by constructing a weir across the Indus at Sukkur, and that this will be rendered necessary sooner or later by the continued abstraction of the water in the Upper Indus and its tributaries by the new Punjab canals. The cost and engineering difficulties of such a work would be very great, and no opinion can be pronounced on its feasibility until it has been more fully considered; but

a great deal can be done in the meanwhile to improve and extend existing canals and the system of distribution.

Bombay (Deccan and Gujarāt).

It will be seen from the table already given that, although nearly every irrigation work in Sind is highly remunerative, those in the Bombay Deccan and Gujarāt are financially failures. Many of them do not pay their working expenses, and the best does not yield a return of much more than 3½ per cent. on its capital cost. The main reason for this is the great cost of storage works and the precarious and unreliable nature of the water supply. A second cause is the inconstancy of the demand in districts where in ordinary years excellent crops can be grown without the aid of irrigation, which is taken regularly only for the more valuable class of crops. For these high rates are paid; but the areas are small, and the total area irrigated by all the works shown in the table, on which a capital expenditure of 272 lakhs had been incurred up to March, 1903, does not on the average exceed 100,000 acres. The Major works and the Minor works with capital accounts are all of the same class and may be considered together. Of the whole thirty-six only two small works are situated in Gujarāt, the remainder being scattered over the Deccan Districts. The most important are the Muthā and the Nīra Canals, in connexion with which two fine Ghāt-fed storage works, known as Lake Fife (Kharakvāsla) and Lake Whiting, have been constructed, which are capable of impounding 3,833,000,000 and 5,312,000,000 cubic feet respectively. The area irrigated from the Muthā Canal may appear remarkably small as compared with its capital cost; but one of the main objects of the work is the supply of water to the cantonment and municipality of Poona and to Kirkee, and the whole cost of the waterworks has been debited against the project. The supply available for irrigation is therefore but a portion of the whole; and it is taken mainly for the highest class of sugar-cane, which is grown in the vicinity of Poona, and which requires frequent and heavy waterings and pays very high rates. The Nīra Canal has been constructed solely as a protective irrigation work, and, although hitherto not directly remunerative, it proved of the greatest value during the severe famines of 1896–7 and 1900–1.

In Bombay, as in several other Provinces, the area irrigated from petty works which are maintained by Government as Minor works for which capital accounts are not kept, exceeds that irrigated from the Major and Minor works on which capital expenditure has been incurred. There are 387 of these petty

works in Gujarāt, which irrigate about 32,000 acres, of which more than two-thirds is in Surat District. The Deccan and Carnatic Districts contain 1,019 of these works, which irrigate on an average about 111,000 acres.

Scope for new works in the Deccan.

Irrigation works in Bombay (excluding Sind) having proved unremunerative, no new works of any importance have been sanctioned in recent years. But the Deccan Districts are so liable to severe famine that there is no part of India in which the protection which irrigation works can afford is more urgently required. The rainfall in the Western Ghāts provides an unfailing supply of water; but the cost of storing and utilizing it would be so great, and the demand for irrigation in ordinary years is so small, that there is little prospect of any work which can be constructed proving directly remunerative. Nevertheless, it is mainly by the multiplication of works of the Nīra Canal type that substantial protection from famine can be obtained, and the value of this may justify the state in incurring the permanent liabilities which the construction of such works must entail.

Madras Major works.

The most important among the nine Major works of the Madras Presidency are the three deltaic systems of the Godāvari, the Kistna, and the Cauvery, which together irrigate more than 2,400,000 acres. In these deltas the conditions are as favourable for irrigation as in the tracts served by the great perennial canals of the Punjab. It has already been stated that irrigation had been extensively developed in the Cauvery delta under native rule, but that the works were added to, strengthened, and improved by Sir Arthur Cotton in 1835–6. The irrigation is here effected not from artificial canals, but from the numerous natural channels into which the river divides after entering the delta. The works consist therefore almost entirely of weirs, escapes, and regulators, constructed for the purpose of controlling the distribution of the supply. After these works had been completed, Sir Arthur Cotton turned his attention to the Godāvari and constructed the canal system on that river between 1847 and 1850. He subsequently planned, but did not himself carry out, the Kistna project. The remaining Major works are of a wholly different character from these three deltaic systems, as they depend more or less on storage works or are carried out in more difficult country. The Kurnool-Cuddapah Canal, as already explained, is part of the great Tungabhadra scheme originally projected by Sir Arthur Cotton, the construction of which was entrusted to the Madras Irrigation Company. This work has

for various reasons never proved a financial success, and even at the present time the gross revenue does not much more than cover the working expenses. The Periyār Project is one of the most interesting works in the Presidency. It consists of a large storage work in Travancore territory, on the western side of the Ghāts, formed by the construction of a concrete dam 156 feet in height across the Periyār river, the natural course of which is towards the Arabian Sea. The impounded water is, however, diverted by means of a long tunnel into one of the tributaries of the Vaigai river, which discharges into the Bay of Bengal below Madura. Many old irrigation works exist on this river, and new works have been constructed for the full utilization of the supplementary supply. The work was opened in 1896; and although the net revenue as yet only covers the charges for interest, it may be expected to improve before long, when irrigation is more fully developed. The only other Major works in Madras which have not proved remunerative are the small Barūr tank in Salem District, and the Rushikulya Project in Ganjām; but the latter was originally constructed as a protective work without any expectation that it would be directly remunerative.

Minor works in Madras.

The twenty-eight Minor works on which capital outlay has been incurred do not call for special remark. They consist either of anicut systems or storage works, or of a combination of these; and they may, on the whole, be regarded as directly remunerative, for the net revenue attributable to them in 1902-3 was equivalent to a return of 7 per cent. on the capital cost. But, as has already been shown, half of the total area in Madras irrigated from works under Government control is dependent on 35,000 petty works which are maintained by the state as works for which no capital accounts are kept. The revenue derived from these small works exceeds 80 lakhs a year, and about 20 lakhs is devoted annually to their maintenance or up-keep.

Scope for extension.

There is no Province in which irrigation is more appreciated or has been longer established than Madras. Many of the works are of great antiquity, and they are to be found in large numbers in almost every District. Except in the deltas, the conditions are less favourable than in the Punjab or Sind for large canals unaided by storage; but, on the other hand, the country is better adapted for the small storage works which form such an important feature in the agricultural economy of the Presidency. There is still a wide scope for the extension of the irrigated area, but few extensions are possible

without storage. The supplies of even the great Kistna and Cauvery rivers are often insufficient for the irrigation at present dependent on them, or for the second crop which might be grown, and proposals have been made to form large storage works on both these rivers. From a protective point of view the most important undertaking which can be proposed is the completion of the Tungabhadra Project on the scale originally suggested by Sir Arthur Cotton. This work would protect very large areas in the Districts of Bellary, Anantapur, Kurnool, Cuddapah, and Nellore, all of which are specially liable to severe distress and famine in years of drought. But storage works of enormous capacity would be required on the Tungabhadra and elsewhere in order to obtain a reliable supply for the whole area that could be commanded, while the canal channels themselves would be very costly owing to the nature of the soil and the configuration of the country. As much of the area that would be served consists of black cotton soil, upon which in ordinary years 'dry' crops can be raised, the demand for water would be much less constant than in the rice-growing tracts; and such a work is not, therefore, likely to prove directly remunerative. There is no doubt, however, that an unfailing supply of water is available, and that, if it can be stored and utilized at an expense which will not be prohibitive, a very large area in these districts could be securely protected from famine. The question is now (1905) being investigated in detail. Numerous other works of a less ambitious character are possible in almost all districts, but practically all will involve the construction of storage works. Such works are likely, however, to be less costly and unremunerative than in the Bombay Deccan, and it seems probable that many schemes can be proposed which will not involve a greater permanent burden on the finances of the state than would be justified by their protective value.

Bengal.

State irrigation works have never hitherto proved remunerative in Bengal. The ordinary rainfall is so great that water is not in constant or regular demand, although there may be a great rush for it during long breaks in the rains, or at critical periods of the rice crop. The three Major works which have been constructed are all unremunerative. The Orissa Canals, to which reference has already been made, do not pay their working expenses, and the Son Canals in Southern Bihār, which are the most successful, do not on the average yield more than 3 per cent. on their capital cost. A small canal, the Tribenī, is now under construction in the north of

Champāran District as a protective work. There is scope for extension of irrigation in Bengal, especially in the Bihār Districts, which are densely populated and the most liable to famine; but until higher rates for water can be obtained from the people, such works are never likely to be remunerative. In Eastern Bengal the rainfall is so abundant that there is no demand for irrigation.

It has already been shown how the canal constructed by Fīroz Shāh on the west bank of the Jumna was reopened in the early part of the nineteenth century, when it was within the Province of Agra. The small canal on the eastern bank was reopened and extended soon afterwards, and now irrigates portions of the Districts of Sahāranpur, Muzaffarnagar, and Meerut. The knowledge and experience gained on these works were subsequently applied by Sir Proby Cautley in the design and construction of the Ganges Canal, which was the first original irrigation work of any magnitude constructed in Northern India, and is even now second to none in the boldness of its conception, and to few in its utility and financial success. It was the pioneer of all the large canals subsequently constructed in the United Provinces and the Punjab. The canal, which was opened in 1854, takes off from the right bank of the Ganges immediately below the sacred *ghāts* at Hardwār, and after being carried over the Solāni river by the celebrated Solāni aqueduct, irrigates portions of nine Districts in the Jumna-Ganges Doāb. Seven Districts in the lower part of the Doāb receive irrigation from the Lower Ganges Canal, which also takes off from the right bank of the Ganges at Naraura, about 130 miles below Hardwār, and was first opened for irrigation in 1878. The Agra Canal, opened in 1874, is a smaller work which takes off from the right bank of the Jumna at Okhla, 11 miles below Delhi, and irrigates portions of the Districts of Gurgaon, Muttra, and Agra. All these canals have proved remunerative; but this cannot be said of the remaining Major work, the Betwā Canal, which takes off from the left bank of the Betwā, a tributary of the Jumna, about 12 miles north of Jhānsi, and irrigates portions of the Jālaun and Hamīrpur Districts in Bundelkhand. This canal, which was opened in 1885, has not a perennial supply, and the demand for irrigation during the period that the river is in flow is very slack, except in dry seasons, so that it does not pay its working expenses. A certain amount of storage (2,700,000,000 cubic feet) has been provided above the weir, where the river is impounded to a height of 56 feet

United Provinces.

above the lowest point of its bed; but this is insufficient. The canal was sanctioned as a protective work and was not expected to be remunerative, but it proved of great value during the severe famine of 1896–7, when it irrigated more than 87,000 acres.

The four Minor works for which capital accounts are kept include three small systems of canals—the Dūn, the Rohilkhand, and the Bijnor, which are all profitable works; and the Bundelkhand lakes, which irrigate 3,000 acres and just pay their working expenses. There are no other Minor works.

It must be added that the canals in the United Provinces have not always conferred unmixed benefit upon the land which they command. In many places their introduction led to a gradual but steady rise in the level of the subsoil water, and resulted eventually in the water-logging of the soil, the increase of malaria, and the further deterioration of *ūsar* or *reh*-covered tracts. To remedy these evils, and to prevent further injury, it was found necessary to incur a large outlay on the re-alignment of some of the older canals, and on the construction of a large system of drainage channels, the aggregate length of which now exceeds 3,000 miles. These measures have proved successful.

Scope for extension of irrigation.

The field for the extension of canal irrigation in the United Provinces is not large. A project for a great canal, to take off from the right bank of the Sārdā river for the irrigation of the Oudh Districts, was prepared in detail more than thirty years ago, but was not sanctioned owing to the doubts expressed as to the necessity for such a work and the opposition of the owners of the lands which would be affected. The project has been several times revived and modified, but has found few advocates among landowners or revenue officers, while it is strongly opposed by many. A smaller scheme has been suggested which would protect the only portions of this tract which have in the past been liable to famine; but there are doubts and difficulties attending this also, and it will not, in any case, be taken up at present. Additional protection from famine is most urgently required in the districts which lie to the south of the river Jumna; but canals in this tract would have to take off from tributaries of the Jumna, the supplies in which, as in the case of the Betwā, can be relied on only for a few months in the year. The most important scheme recently sanctioned as a protective work is a canal from the river Ken, to protect a large portion of Bāndā District which suffered severely in the famine of 1896–7; but however valuable

works of this kind may be in this tract in seasons of drought, there appears to be little hope of their proving directly remunerative.

The irrigation works in Ajmer-Merwāra consist entirely of tanks, which were either made or restored about 1850, under Colonels Hall and Dixon. There are no natural rivers on which reliance can be placed for irrigation, and the rainfall is so irregular, and often so inadequate, that wells are apt to run dry. In such tracts tanks are of the greatest value, not only on account of the irrigation directly effected from them, but as a means of maintaining the spring level in the wells in their vicinity. Tanks have been constructed in almost every available catchment basin, and every effort has been made to utilize to the utmost the scanty rainfall, so that there is little room for the extension of irrigation in this small territory. In favourable years the tanks are capable of irrigating nearly 40,000 acres, but in a dry year not more than one-third of this can be protected. In ordinary years the works yield a net revenue equivalent to about 3 per cent. on their capital cost, but in dry years working expenses are sometimes not covered. Apart from the tanks the only means of irrigation is from wells, the area under which varies from 44,000 to 108,000 acres according to the season. Ajmer-Merwāra.

Two small works have been constructed by the British Government in the Quetta-Pishīn District of Baluchistān, which irrigate between them from 4,000 to 8,000 acres, according to the season, but at present they do not quite pay their working expenses. Other small works have been proposed recently, but all permanent supplies of water are now so fully utilized that there is little scope for new state irrigation works. Private irrigation works, utilizing the waters of perennial streams and to a certain extent the flood-waters of hill torrents, are numerous; but the distinctive private irrigation works of Baluchistān are the *kārez*, or underground tunnels, which tap the subsoil supply of water on high ground and lead it on to the surface of lower country. The people display much skill in the construction of these works, for which the country is well adapted. Baluchistān.

Irrigation is not required in Lower Burma, where the rainfall is so regular and abundant that rice, the staple crop of the country, can be grown without it. Up to 1901 there were no Major irrigation works in operation in Upper Burma; but two projects—the Mandalay and the Shwebo Canals—were then under construction. The former was opened in 1902–3 and irrigated upwards of 7,000 acres in that year; the latter was Upper Burma.

opened in 1906. These two works are estimated to cost 95 lakhs, and to irrigate together about 230,000 acres, and there is reason to believe that both will prove remunerative. Another scheme, known as the Mon Canals, of about the same scope as each of these works, has also been sanctioned, and is now (1905) under construction. There are about 200 Minor works, for which capital accounts are not kept, but which are now administered and maintained by the state. Most of these existed before the annexation, but many had fallen into disuse. About 50 lakhs has since been spent on restoring or repairing them, and in 1902–3 they irrigated about 400,000 acres.

Private irrigation works are also numerous in Upper Burma, especially in the Magwe District, or on the tributaries of the Irrawaddy. The area irrigated by these is estimated at 475,000 acres, of which 300,000 acres are from small canals, and the balance from tanks and other sources.

Central Provinces and Berār: Assam and Coorg.

There are at present no state irrigation works in the Central Provinces, although, as already shown, certain rice-growing districts possess no less than 50,000 small private tanks, capable of protecting from 150,000 to 650,000 acres according to the season. The necessity for protective irrigation does not appear to have been recognized until recently, as the pressure of population was light. Moreover, until 1896 a complete failure of the rains was hardly known, and in many parts of the Province the cultivation is said to have suffered more frequently and severely from excessive rainfall than from drought. Under such conditions the people are never likely to pay as much for irrigation as it will cost to provide it, but the Province has suffered so severely from famine during the last five or six years that the construction of suitable state irrigation works is contemplated as a protective measure. In Berār there are practically no irrigation works of any kind, state or private, except wells. Here, too, the necessity for irrigation works has not often been felt, but the Province was seriously affected by the failure of the later rains in 1896, and severe famine occurred in 1899. Storage works may be possible in the hilly tracts in the north and south known as the Melghāt and Bālāghāt, but tanks in the latter tract would not be secure from failure in years of severe drought.

Irrigation works are not required in Assam, where the rainfall is heavy and unfailing; nor in any part of Coorg, except in a narrow strip on the eastern border, in which failure of the rains occasionally occurs and where a few petty works have been constructed.

The Irrigation Commission of 1901–3 estimated the total area ordinarily irrigated in British India from all sources as below, the total cultivated area being taken at 226,000,000 acres :— Total area irrigated in British India from all sources.

SOURCE OF IRRIGATION.	State works.	Private works.	TOTAL.
	Acres.	Acres.	Acres.
Wells	...	12,895,000	12,895,000
Canals	15,644,000	1,235,000	16,879,000
Tanks	2,944,000	5,194,000	8,138,000
Other sources . . .	...	6,186,000 *	6,186,000
GRAND TOTAL	18,588,000	25,510,000	44,098,000

It should be noted that the figures given in this table do not include the large areas directly watered by river floods, nor the many thousand acres which, though not directly irrigated in the ordinary sense, are artificially saturated by rain-water held up within field embankments.

It is difficult to determine the increase of area under private works since 1878. As regards wells, the question has been already referred to, and it may be doubted if there has been a greater increase under private works of other kinds than under wells. With regard to state works there is no difficulty, and it may be safely said that between 1878 and 1903 the area under irrigation increased from 10,500,000 to 18,500,000 acres; of this increase nearly 7,000,000 acres are due to Major works.

The financial results of state irrigation works are discussed in Volume IV, chapter vi (Finance).

The distribution of the total irrigated area among Provinces is shown in the table on the next page. Distribution of total irrigated area among Provinces.

The actual area for each Province in any one year may differ considerably from that shown in the penultimate column. In a very dry year tanks are liable to fail and the area irrigated by them falls very short. On the other hand there is an unusually strong demand for water in such years, and the greatest inducement to economy in its use, so that maximum areas are often then irrigated by perennial canals or from wells in which the supply is maintained.

* The area shown under 'Other Sources' includes a large area (5,000,000 acres) irrigated in Bengal from private canals, and from water held up in natural depressions and in shallow artificial tanks.

PROVINCE.	Population (1901).	Average area annually cultivated.	Area ordinarily irrigated from all sources.	Percentage of irrigation on area cultivated.
		Acres.	Acres.	
Punjab and North-West Frontier Province . .	22,357,000	28,207,000	10,430,000	37·0
Sind	3,211,000	3,323,000	2,923,000	88·0
Bombay proper .	15,305,000	24,327,000	1,077,000	4·4
Madras . .	38,209,000	36,574,000	10,532,000	28·8
Bengal . . .	74,745,000	63,664,000	6,349,000	10·0
United Provinces .	47,692,000	41,086,000	11,055,000	26·9
Ajmer-Merwāra .	477,000	388,000	142,000	36·6
Baluchistān . .	308,000	(?)	5,000	. .
Upper Burma .	3,847,000	4,666,000	828,000	17·7
Central Provinces .	9,877,000	16,814,000	700,000	4·2
Berār . . .	2,754,000	6,820,000	56,000	0·8
Coorg . . .	181,000	195,000	1,000	0·5
TOTAL	218,963,000	226,064,000	44,098,000	19·5

Irrigation in Native States.

A few remarks may be made about irrigation in Native States. The Irrigation Commission of 1901–3 obtained statistics from all the more important States in which irrigation is practised, excepting those in Burma and Baluchistān. These statistics covered an area of 438,000 square miles, the population in which amounts to 51,326,000. The average area cultivated is estimated at 71,076,000 acres, of which 7,763,000 acres, or 10·9 per cent., are irrigated in an ordinary year. After making some allowance for areas not included in the returns, the Commission estimated the total area annually irrigated in the Indian Empire, excluding the Native States in Burma and Baluchistān for which no particulars can be given, at 53,000,000 acres, of which 19,000,000 are irrigated from canals, 16,000,000 from wells, 10,000,000 from tanks, and 8,000,000 from other sources.

Mysore.

Among individual States the first place may be given to Mysore, where there are said to be about 39,000 tanks, or four to every three square miles. Almost every valley contains a chain of such tanks, the first overflowing into the second, and so on until the terminal tank is filled. The largest existing tank has a capacity of 3,118,000,000 cubic feet; but there are only ten tanks with a capacity of over 270,000,000 cubic feet, and not more than 2,300 are capable of irrigating 80 acres or more. The average area irrigated annually by all tanks is about 540,000 acres. There are also about 1,000

miles of canals or river channels, which irrigate about 100,000 acres. The well area is about 70,000 acres. The State is now constructing two very large storage works, the Bora Kanave and Māri Kanave reservoirs, which are to have storage capacities of 2,354,000,000 and 30,000,000,000 cubic feet respectively. The latter work, which is being constructed on the Vedāvati or Hagari river, a tributary of the Tungabhadra, in Chitaldroog District, will have a masonry dam 142 feet high, and a waterspread when the lake is full of over 40 square miles. It will then have a capacity very nearly equal to that of the Nile reservoir at Assuān, but the lake will only fill during years of extraordinary rainfall, or perhaps not more than once in thirty years. In a year of average rainfall the tank will not impound more than 10,000,000,000 cubic feet, but it has been proved more economical to build the dam to the height proposed than to provide the necessary escape at a lower level.

In the Hyderābād State an area of about 773,000 acres is said to be irrigated in years of normal rainfall, but in a dry year, such as 1899–1900, this area is reduced to less than half. Most of this irrigation is from tanks, of which there are said to be 18,000, but the capacity of the largest of these does not exceed 300,000,000 cubic feet. Some of these tanks are of great antiquity, but the majority of them were until recently breached and ineffective. A great deal has, however, been done to repair them since 1893: more than 7,000 have been restored, while many projects have been prepared for the restoration of others or the construction of new works. There are also some small canals which take off from the left bank of the Tungabhadra river, and irrigate nearly 4,000 acres, and a new work of this kind has been recently sanctioned which is estimated to irrigate 10,000 acres. Hyderābād.

In the Native States under the Madras Government, 625,000 acres, or more than 57 per cent. of the average area cultivated, are said to be irrigated. In Bombay the area irrigated in Native States, including Baroda, in years of normal rainfall is estimated at 1,147,000 acres, but this is less than 5 per cent. of the area cultivated. In the Rājputāna Agency, where the need for irrigation is very great, about 1,172,000 acres, or 18 per cent. of the area cultivated, are irrigated from wells and tanks in years of good rainfall, but the irrigation is very precarious. The States best protected are Jaipur, Bharatpur, Shāhpura, Kishangarh, Alwar, and Kotah. The Jaipur State has done a great deal during the last thirty years, under the advice Other States.

of Colonel Sir Swinton Jacob, in constructing irrigation tanks and in advancing money for the construction of wells; and in Bharatpur a sum of 10 lakhs has been spent since 1897, principally in constructing embankments for impounding and distributing spill waters from the Bāngangā and other rivers, which has resulted in an increase of 50,000 acres in the irrigated area. There is scope for extension of irrigation in some of the Rājputāna States, but the rainfall is so uncertain that sites for reliable storage works are not easy to find, and the question is complicated by territorial difficulties. Rājputāna is, however, in such urgent need of protection that investigations are now (1905) being made with the object of drawing up projects for utilizing to the best advantage all available sources of water-supply. In the Central India States irrigation is not very extensively practised, and the total area irrigated from all sources does not amount to 6 per cent. of the average area cultivated; but many tracts are liable to severe drought. In the Native States of the Punjab nearly 2,000,000 acres are irrigated in ordinary years, of which about 750,000 acres represent irrigation from the Sirhind and Western Jumna Canals in the States of Patiāla, Nābha, Jīnd, Farīdkot, and Kalsia, while an equal area is irrigated in the Bahāwalpur State by means of the Bahāwalpur inundation canals which take off from the left bank of the Sutlej.

Irrigation revenue.

The revenue receipts from Government irrigation works are derived almost entirely from the charges made for water or for water advantages; and these charges depend throughout India not on the volume of water supplied, the amount of which may vary largely according to the character of the season and other considerations, but on the kind of crops cultivated and the areas actually or ordinarily irrigated. In former days, when land revenue was taken in kind, the state's share of the produce increased with the introduction of irrigation; and it was in anticipation of such an increase that rulers or farmers of land revenue constructed, or contributed towards the cost of constructing, irrigation works.

Consolidated with land revenue.

When, under British rule, the system of cash payments succeeded, and assessments were made with reference to average produce, lands which were assured of irrigation were naturally assessed at higher rates than similar lands which did not enjoy this advantage. The difference between this 'wet' rate and the ordinary 'dry' rate leviable on unirrigated land of the same class represented the true revenue earned by or due to the works. In Madras almost all the new works

included a considerable area of old irrigation, dependent on works which were superseded by or incorporated in the new works. In the case of lands newly brought under irrigation, power was taken to impose a water-rate which might be levied on the whole area for which water had been applied (or in some cases on the areas actually irrigated) in addition to the 'dry' rate; but in course of time the two rates were consolidated at revision of settlement, the consolidated rate representing the land revenue assessed on the land entitled to irrigation, in consideration, among other things, of its water advantages. This system is still followed throughout the Madras Presidency, in Sind, on a number of old irrigation works in Bombay, and in the Burma Districts which have undergone settlement. It has many advantages where, as in Southern India, over 90 per cent. of the irrigated area is under rice cultivation and water is delivered to the same fields year after year, and when the practice is in accordance with immemorial usage. In Northern India, however, where the new perennial canals were carried into tracts where irrigation had been before unknown, and water was applied to a number of different kinds of crops, and to different fields in different seasons (for the area actually irrigated in a single year is often not more than a third or fourth of the area under command), it was found that this system was inapplicable, the demand from particular lands being less constant, and the irrigation much more widely diffused.

Or levied by separate rates.

In the Punjab and the United Provinces, and also in Bengal (where the land is under permanent settlement), the charge for water is distinct from and independent of the land-revenue assessment, and is levied in the form of a water-rate on the occupier. The occupier's rate varies according to the crop grown, and in the first two Provinces is chargeable only in respect of fields for which water has actually been taken. In Bengal it has been found convenient to introduce a system of long water leases (five or seven years) for blocks of land comprising many holdings, and each occupier is charged according to the area of his holding within the block, whether he has actually taken water or not. The occupier's rate is subject to periodical revision, and remissions are freely given in case of failure of crops, even when this is not due to the irregularity or insufficiency of the supply. It has been found, however, that the occupier's rate does not prevent a rise in rents due to water advantages. In the Punjab and the United Provinces, where the land revenue has not been permanently settled, the

Government can take a share of this increase at revisions of settlement; and under the Northern India Canal and Drainage Act, 1873 (which does not apply to Bengal), it may, during the currency of a settlement, impose, in addition to the occupier's rate, an 'owner's rate' on lands which have been brought under irrigation after the settlement was made, provided that such rate does not exceed half the increase in the rental value of the land due to irrigation. This rate, like the occupier's rate, is leviable only on lands which have actually received irrigation during the year.

On the inundation canals in the Punjab which were taken over at annexation, the land revenue was until recently fixed with reference to water advantages, in accordance with ancient custom, and no other charges were made for irrigation. But in accordance with the same custom the people were also required to carry out, or to contribute to the cost of, the annual canal clearances. On the Multān and Muzaffargarh Canals this obligation was enforced by means of the now moribund *chher* system, under which each owner was required to send to the canal clearances a number of labourers proportionate to the extent of his holding which had been irrigated during the previous season. On the Dera Ghāzi Khān Canals a fixed 'clearance-rate' equal to half the estimated average cost of the clearances was levied rateably on all owners. The supply in inundation canals is liable to such fluctuation that a fixed land revenue was open to many objections, and the people no longer desired the continuance of the *chher* system. At the last re-settlements of these districts it was therefore decided to impose an occupier's rate in addition to an assessment at 'dry' rates, Government undertaking the clearance by hired or contract labour in the ordinary way. The change is being introduced gradually, and the practice of *chher* clearances (which has sometimes been incorrectly regarded as forced labour) is still followed on some of the canals, but will in a few years cease to exist.

Occupiers' rates are also levied on all the Major, and on several Minor, works in the Bombay Deccan. In Sind, where almost all cultivated land is irrigated, the charge for water forms part of the land-revenue assessment; but the latter varies with the method of irrigation applied (flow or lift), with the area under cultivation, and, to a certain extent, according to the crop sown. Nine-tenths of the revenue assessed on irrigated lands is regarded as irrigation revenue, for which the canals are entitled to credit.

The charges for irrigation, whether taken in the form of enhanced land revenue or of occupiers' and owners' rates, vary very much, depending on the kind of crop, the quantity of water ordinarily required for it and the time when it is required, the quality of the soil, the intensity or the constancy of the demand, and the value of irrigation in increasing the out-turn. In the immediate vicinity of Poona a rate of Rs. 50 per acre is paid for sugar-cane. This is a quite exceptional rate, and obtains only over a limited area. On other parts of the Muthā Canal the rate varies from Rs. 40 to Rs. 12, and on other canals in the Bombay Deccan from Rs. 25 to Rs. 10 per acre. In Madras the maximum rate for sugar-cane is Rs. 10, and in the Punjab it does not exceed Rs. 8-8. The rate charged for rice varies in Madras from Rs. 5 to Rs. 2, and in Bengal from Rs. 2-8 to R. 1-8 per acre. In both these Provinces irrigation is practically confined to rice; in the Punjab, where this crop is not extensively grown, the rate varies from Rs. 7 to Rs. 3-4 per acre. The ordinary rate in the Punjab for wheat, which is the principal crop, varies from Rs. 4-4 to Rs. 3-12, and for fodder crops from Rs. 3 to Rs. 2-8, per acre. The average rate realized on Major works from irrigation of all kinds is about Rs. 3-8 per acre, the Provincial averages being R. 1-9 in Sind and Bengal; Rs. 3-4 in the Punjab; and Rs. 4-8 in Madras, the United Provinces, and the Bombay Deccan. The working expenses per acre vary from 8 annas in Sind to Rs. 2-8 in the Bombay Deccan, the average for all Provinces being about R. 1-1. The charges for irrigation may be taken as varying from 10 to 12 per cent. of the value of the crop, except in Bengal and the Bombay Deccan, where the average is little more than 6 per cent.

Average charges for irrigation.

During the famines that occurred in nearly every Province of British India, and in most of the Native States, between 1896 and 1901, the protective value of irrigation was very plainly shown, in spite of failures of some of the smaller storage works; and the question naturally arose whether this protection might not be extended to those tracts in which the most severe distress had occurred, and in which means of irrigation had not been provided or were inadequate. In 1901 the Government of India referred this question to a Commission which was directed to report (*inter alia*) on the extent to which irrigation had been provided by works constructed by the state, and on the results—productive, protective, and financial—which had been attained; to determine the scope which existed for further extensions of state irrigation works, and the probable

The Irrigation Commission of 1901-3.

net cost of carrying them out; and to consider the extent to which local capacities for irrigation had already been utilized by private individuals, and the manner in which it might be possible to stimulate the extension of private irrigation works. Sir Colin Scott Moncrieff was appointed President of the Commission, which completed its report (from which many of the statements and figures in this chapter have been quoted) in April, 1903.

Recommendations of the Commission.

The Commission reported that the Major irrigation works constructed by the state have been, on the whole, so profitable that the surplus revenue, after meeting all interest charges on the capital outlay, now exceeds a crore of rupees a year; but they found that the field for the construction of new works of any magnitude on which the net revenue would exceed the interest charges was very limited, being restricted to the Punjab, Sind, and parts of Madras, and that the tracts in which most of such works could be constructed were not liable to famine. They recommended that such works of this class as were feasible should be constructed as soon as possible, as they would not only be profitable investments, but would have a protective value in increasing the food supplies of the country. They recognized that irrigation works could not possibly prove directly remunerative in the areas where protective irrigation was most urgently required, such as the Deccan Districts of Bombay and Madras, the Central Provinces, and Bundelkhand; but they were of opinion that such works might be undertaken in these tracts as would tend to reduce the cost and mitigate the intensity of future famines, although they would not pay much more than their working expenses. For the protection of the Bombay Deccan they recommended the construction of storage works, like Lakes Fife and Whiting, in the Western Ghāts, where the rainfall has never failed even in the driest years. For Madras they recommended a detailed investigation of the old Tungabhadra project, or some modification thereof, and of a scheme for a storage work on the Kistna, on the understanding that it was not essential that either scheme should fulfil the conditions of a productive work, provided that it would afford, at a reasonable cost, reliable protection from famine to the districts which are now most liable to it. They also proposed that Government should undertake the construction of protective works in the rice-growing districts of the Central Provinces, and recommended the Ken Canal project in Bundelkhand and the examination of the rivers which traverse that territory for sites

for storage works. The investigations which have been undertaken in the Rājputāna States were also started on the recommendation of the Commission, who proposed that they should be extended to the Central India and Kāthiāwār States. The Commission further sketched out a rough programme of new Major works to be constructed in different parts of India, which would cost not less than 44 crores of rupees, and would result in an increase of 6,500,000 acres in the irrigated area. It was estimated that the construction of these works would impose a permanent yearly burden of nearly 74 lakhs on the state, through the excess of interest charges on capital cost over the net revenue due to the works. Against this would have to be set, however, the reduction in the cost of future famines resulting from the construction of the works, which, the Commission thought, could not be estimated as likely to average less than 31 lakhs per annum. The balance of 43 lakhs would represent the net annual cost of the works to the state, or the price to be paid for the protection from famine which the works would afford, and for all other indirect advantages that might be attributed to them. The Commission also called attention to the fact that the area actually protected by private irrigation was greater than that which is dependent on all the works constructed or maintained by the state; and considered that a great deal might be done to encourage the extension of such works by a more liberal and elastic system of Government loans, by grants-in-aid in famine tracts, and by other means. The Commission were, however, of opinion that, although much could be done by irrigation to restrict the area and to mitigate the cost and distress of famine, India could not be entirely protected from famine by means of irrigation alone. They estimated also that, if all the works which they proposed could be constructed, they would not intercept for purposes of irrigation more than 2¼ per cent. of the volume of water which now, unused, flows onward to the sea. The practical application of these proposals is under consideration; and the annual allotment from revenue for expenditure on irrigation projects, which stood at one crore between 1900–1 and 1903–4, has now (1904–5) been raised to 1¼ crores.

Comparative merits of irrigation works and railways as a means of

The relative merits of railways and irrigation works as a means of preventing famine have often been the subject of discussion, but the claims which may be made on behalf of either are not conflicting, for the means of production and distribution must be regarded as mutually supplementary.

famine protection.

Railways do not, like canals, increase the food-supply of the country, but they render possible the transfer of surplus supplies to parts which require them. They are the only means of ensuring a food-supply in times of famine to many tracts where irrigation is impossible or could only be supplied at a prohibitive cost. Again, the protective value of many of the most important irrigation works, such as those which have converted into unfailing granaries the unpopulated and uncultivated wastes of the Punjab and Sind, depends on the existence of railways by which the surplus produce may be readily and cheaply distributed. It may be that the construction of a particular railway might well have been held in abeyance in favour of an irrigation work, or vice versa; but improvement in the means of production and of distribution must nevertheless proceed concurrently. The smallness in the difference of prices in all parts of the country during the famines which have occurred since 1896 is the best justification of the policy of railway extension as an alleviation of famine. Irrigation works can do much, but they cannot by themselves give as complete or universal protection as is required.

Navigation

Connexion of irrigation with navigation.

Inland navigation and irrigation are closely connected, for each depends for its fullest development in India on the construction of canals. If the natural waterways of the country are to be utilized to the utmost for the purpose of communications, it is as necessary to connect them by navigable channels as it is to tap their waters by canals for purposes of irrigation. At first sight it may appear that the same channels might be made to serve both purposes, and that when the great cost of constructing a large irrigation canal has been undertaken, there should be no hesitation in incurring the extra expenditure required to render it navigable. Even if the revenue to be anticipated from navigation dues should be insufficient to yield an adequate return on the additional capital outlay involved, it may be admitted that unremunerative expenditure of this kind would be justified if there were a certainty that the canal would be extensively used for navigation, that a new line of communication would be established, and that a material saving would be effected in the cost of transport. Apart, however, from all questions of cost, it has been found that the exigencies of irrigation and navigation are not always com-

patible, and that traffic is not attracted to a navigable canal which does not pass through large cities or important trade centres, or which is not in uninterrupted connexion either with the seaboard or with the waterways which form the most convenient outlet for the produce of the tract which the canal traverses. Hence it happens that irrigation canals are not always suitable for navigation, and, on the other hand, that many canals have been constructed for purposes of navigation only and do not irrigate a single acre. It will be convenient to consider in the first place the system of irrigation canals which are also navigable.

Godāvari and Kistna Canals.

The two most important navigable systems of irrigation works are the Godāvari and Kistna Canals in the Madras Presidency. The total length of the main canals and branches of these systems is 506 and 372 miles respectively, of which 493 and 332 miles are navigable. There were strong reasons for applying these canals to navigation. During many months in the year they carry away all, or nearly all, the river supply, and so cut off the upper waters of the rivers from the seaboard. They traverse flat and fully cultivated deltas, in which there are no great falls to be overcome, and which are ill provided with roads or other means of communication, while the people on the coast are accustomed to the use of boats. The navigable canals which have been made radiate from the head-works at Dowlaishweram and Bezwāda towards the sea, which connects their lower ends, while the head of each system is connected with the other, with the upper waters of the Godāvari and Kistna, with the Buckingham Canal, and with the railway system of the country. The total number of boats entering the two systems annually is about 80,000, with a tonnage estimated as varying from 700,000 to 800,000 tons, and there is also a small amount of raft traffic. The facilities for navigation are undoubtedly a great boon to the cultivators and tend materially to reduce the cost of transport; but although great use is made of them, it cannot be said that navigation even here is directly remunerative. The navigation receipts, which have been materially affected by the opening of direct rail communication along the east coast, average only $1\frac{1}{2}$ lakhs per annum, and do not as a rule exceed the working expenses, so that there is little direct return on the expenditure incurred in rendering the canals navigable. On the other hand, the assessment on the irrigated lands would no doubt have to be considerably lower if the people did not enjoy their present advantages of cheap transport.

Kurnool-Cuddapah Canal.

The only other irrigation work in Madras which has been adapted for navigation is the Kurnool-Cuddapah Canal, but here the conditions are very unfavourable. The canal is navigable throughout its entire length of 190 miles, in which there are no less than forty locks. It has, however, no water connexion with the seaboard, although it is connected with two railways, at its 109th mile and at its tail (Nandyāl and Cuddapah). The traffic is practically *nil*, although no navigation dues are levied, while the navigation charges exceed Rs. 10,000 a year. The advantages of navigation would probably have been more appreciated if the complete Tungabhadra project as originally conceived had been carried out, if a navigable connexion with the seaboard through Nellore District had been provided, and if large storage works had been constructed on the Tungabhadra so as to ensure at all seasons an adequate supply for purposes of navigation. However this may be, there is little prospect of navigation ever being successfully developed on the existing canal.

Navigable irrigation canals in Bengal.

The three Major irrigation works in Bengal have all been adapted for navigation. The Orissa Canals comprise 280 miles of main canals and branches, of which 205 are navigable, as is the whole length of the Midnapore Canals (72 miles). It was originally proposed to connect these two systems by a high-level canal, which would afford a continuous water communication between Cuttack and Midnapore and thence to Calcutta; but this was only carried as far as Bhadrakh on the Salandī river. In the absence of such a connecting link, the boats on the Orissa Canals proceeded to Calcutta via Chāndbāli and the Bay of Bengal. But in order to provide inland communication for small craft, the Orissa Coast and Hijilī Canals, which are purely navigation canals, were subsequently constructed; and there is now free and uninterrupted water communication at all seasons between Cuttack at the head of the Orissa delta and Geonkhāli, near the confluence of the Rūpnārāyan and Hooghly rivers a few miles above Diamond Harbour. The construction of these two navigation canals has not resulted in such an increase in traffic on the Orissa system as was anticipated. During the year 1902–3 the combined navigation receipts of the three canals were less than Rs. 1,40,000, and the net revenue did not amount to Rs. 23,000, although the capital expenditure incurred on account of navigation alone cannot be estimated at less than a crore of rupees. Even less favourable results may be anticipated in future, as the traffic is affected by the recently

constructed extensions of the Bengal-Nāgpur Railway. The Midnapore Canal has been more successful as a navigation work, but here also the traffic is likely to be affected by the railway.

The three main canals of the Son system, with an aggregate length of 218 miles, are all navigable and tail into the Ganges at Buxar, Arrah, and Dinapore. The traffic has always been very moderate, and the tolls do not cover the working expenses due to navigation. During the last two years the receipts have suffered serious diminution in consequence of the opening of the Mughalsarai-Gayā Railway; in 1902-3 they did not amount to Rs. 19,000, which is about a quarter of the average for the three years ending March, 1899.

Navigation in the United Provinces.

In the United Provinces the main lines of the Upper and Lower Ganges Canals (275 miles) and of the Agra Canal (100 miles) are navigable throughout. The Ganges systems are connected with the Ganges river at Cawnpore, and the Agra Canal has a channel leading into the Jumna river near Agra, while it is connected at its head, by means of the Okhla navigation channel, with the Western Jumna Canal in the Punjab[1]. It might have been expected, therefore, that a considerable through traffic to Calcutta would be developed, but as a matter of fact the traffic is purely local and of inconsiderable volume. The average number of boats plying monthly on the canals in the United Provinces is less than 250, and the traffic receipts do not average more than Rs. 15,000 per annum, which is about half the amount of navigation working expenses.

Punjab.

In the Punjab the only navigable canals are portions of the Western Jumna and Sirhind systems. The former is navigable from its head to Delhi, and is then, as already stated, connected with the Agra Canal and the Jumna. A portion of the Hānsi branch is also navigable, the total length of navigable channels being 207 miles. The Sirhind Canal is navigable for 180 miles, or from its head at Rūpar to Ferozepore, where the canal connects with the river Sutlej, and there is a continuous waterway onwards to Karāchi. The boat traffic on these canals is so insignificant that the details are not recorded, and the boat-tolls on both together amount to less than Rs. 5,000 per annum. There is, however, a considerable raft traffic, particularly on the Western Jumna Canal, where the rafting dues average about Rs. 40,000 per annum. The rafts consist principally of timber, sleepers, scantling, and bamboos,

[1] The Agra Canal was closed to navigation in June, 1904.

which are floated down from the hills to the canal heads, and are then passed into the canals. These rafts used to pass down the rivers before the canals were constructed, but the abstraction of the whole of the cold-weather supply has rendered the canal route necessary. The effect of constructing the canals has therefore been to divert rather than to create traffic.

Sind.

Inundation canals are not adapted to navigation, with the single exception of the great Fuleli Canal in Sind, which enjoys an almost perennial supply and is so situated that it has been possible to render it navigable at a very moderate cost. The Eastern Nāra, which takes off from the left bank of the Indus above Sukkur, is also navigable all the year round.

Navigation works which are not also irrigation works. Madras.

Besides the state irrigation works which are also navigable canals, Madras and Bengal possess other canals which have been constructed solely for purposes of navigation. In the former the most important work is the Buckingham Canal, which is connected with one of the branches of the Kistna system and then, proceeding almost due south, skirts the Coromandel coast for a distance of 262 miles, and passes through Madras city. It is a tidal canal, and costly locks have been required at each of the numerous river-crossings, so that the capital cost of the work amounts to nearly 90 lakhs of rupees. There is a moderate traffic on this canal, on which more than 200,000 tons of goods are carried annually; but this also has been affected by the extension of rail communication along the east coast, and the navigation receipts do not fully cover the working expenses. Nevertheless the work must be regarded as one of considerable public utility. There is also a navigation coast canal in Tanjore District, known as the Vedāranniyam Canal, and a small canal connected with the Chilka Lake in Ganjām District. Madras possesses no other navigable canals, but has many miles of natural waterways formed by river backwaters, especially on the west coast, and on these there is a very considerable traffic. Mention may also be made of the works on the first rocky barrier on the Godāvari, at Dummagudem, 120 miles above the head of the Godāvari Canals at Dowlaishweram, which render that river navigable for boats to the foot of the second barrier, a distance of 188 miles.

Bengal.

Reference has already been made to the Orissa Coast and Hijilī Tidal Canals in Bengal. There are two other important works in the Province, the Calcutta and Eastern Canals, and the Nadiā Rivers. The former consist of short lengths of

locked canals and open channels which have been made for the purpose of connecting many of the natural river-channels in the deltas of the Ganges and the Brahmaputra, so as to provide a continuous interior line of communication between Calcutta and the Sundarbans, Eastern Bengal, and Assam, for the benefit of steamers, flats, and small craft constructed for inland waters. These works are of great importance, for they comprise a length of 735 miles of navigable canals and river-channels. There is a great deal of traffic, the average tonnage of cargo and passenger-boats amounting to over 1,000,000 tons a year. The works are more nearly self-supporting than any other navigation works in India. The capital expenditure has been about 68 lakhs, the average annual receipts amount to $4\frac{1}{4}$ lakhs, and the net revenue exceeds $1\frac{1}{2}$ lakhs. The Nadiā rivers comprise the Bhāgīrathi, the Jalangī, and the Mātābhānga, which constitute the upper waters of the Hooghly. These rivers have not been canalized, nor has any capital expenditure been incurred on navigation works. Steamers can navigate them from July to October, but in very dry years they are not open even to small craft throughout the remaining months. Some expenditure is incurred annually in keeping open the channels, which have an aggregate length of 472 miles. The aggregate capacity of the boats using them amounts to about 500,000 tons per annum, and the tolls to 1 lakh, the average working expenses being about Rs. 1,20,000.

Burma.

In Burma, which abounds in natural waterways, there are only two important navigable canals, the Pegu-Sittang and the Sittang-Kyaikto. These are maintained by Government, but no capital expenditure on them has been recorded. The receipts on the former amount to about Rs. 1,40,000 per annum, but do not cover the working expenses. On the latter no revenue is realized, but about half a lakh is spent annually on maintenance. Some expenditure is also incurred on the conservancy of navigable rivers, so as to facilitate navigation.

General results attained on navigation works.

From the foregoing description of the navigable canals in British India it will be seen that not one of them, whether intended primarily for irrigation or constructed solely as a navigation work, is directly remunerative, and that in many cases the navigation receipts do not cover the working expenses. The extension of navigation works must therefore depend for its justification on the benefits which the country will derive from a reduction in the cost of transport. This reduction will

be real and material only in those tracts where the public can be trusted to avail themselves freely of the advantages offered by water communications. There is no Province in which facilities for navigation are so likely to be appreciated as in Eastern Bengal, with its dense population, its thriving industries, and its innumerable river channels. There is great scope for further extensions of inland navigation in this tract; and if the works will not prove directly remunerative, they are not likely to impose a heavy permanent charge on the state, while they will be of great value in increasing the wealth of the community. Navigation advantages have also been fairly appreciated in the deltas of Orissa and Madras, and have certainly proved of great value to the cultivators. Elsewhere, as on the Kurnool-Cuddapah and Son Canals, or the great perennial canals in Northern India, navigation may be regarded as a failure. Not only have the works required in connexion with it been very costly, but the people have evinced no desire to avail themselves of the means of navigation afforded. There is, moreover, another objection to the combination of navigation with irrigation on perennial canals which deserves notice. Navigation is not only costly, but cannot be maintained during seasons of short supply without detriment to the efficiency of the canal as an irrigating work. In general it may be said that, outside the deltaic tracts in Bengal, Orissa, Madras, and Sind, navigable canals will never be of much use or value as a means of inland communication.

Navigable rivers.

We have hitherto referred only to navigation works by which the natural waterways of the country have been artificially connected. It remains to consider briefly the value of these waterways themselves as a means of inland communication. Some of the large rivers of India, such as the Narbadā and the Tāpti, are unfortunately, by reason of their rocky beds and swift floods, practically useless for navigation except at their mouths. The Indus, the Ganges, and the Brahmaputra are navigable by steamers all the year round, or for the greater part of the year, for hundreds of miles above their mouths, or above the heads of the navigable canals traversing their deltas. The Indus is thus constantly navigable as high as Dera Ismail Khān in the North-West Frontier Province, 800 miles inland and 250 miles beyond the Sind border. Its tributaries, the Chenāb and the Sutlej, are open to small craft all the year round, but there is little traffic above Chiniot on the former and Ferozepore on the latter. The Fuleli Canal and the Eastern Nāra may be regarded as navigable branches of the Indus. The Ganges is

navigable as high as Cawnpore, and steamers also pass up the Gogra as far as Fyzābād. Steam navigation on the Indus and the Upper Ganges has, however, been greatly reduced by the development of rail traffic, though on the Bengal portion of the Ganges it is still active. The Brahmaputra is navigable by steamers as high as Dibrugarh, and there is steam navigation on its tributary the Surmā as far inland as Sylhet and Cāchār. The Hooghly is navigable all the year round up to Nadiā, and steamers can pass up the Nadiā rivers above this point from July to October. The great rivers on the east coast of the Peninsula—the Mahānadī, the Godāvari, and the Kistna—are all navigable for some distance above the heads of their deltas, but the traffic on them is not very considerable. Many tributaries or branches of these rivers are also navigable during the monsoon months, and several are open to small craft all the year round. There are, in effect, all round the coast innumerable small rivers, creeks, and backwaters affording facilities for water transport which are fully utilized by small native craft; but outside the zone of such operations inland navigation is practically confined to the deltas and to the valleys of the great rivers which form the natural waterways of the country.

As to Burma, there is no Province in which the natural waterways afford greater facilities for inland navigation, or in which it is more extensively practised. In the Arakan Division the Mayū and Kaladan rivers are navigable by steamers during a great part of the year for distances of 50 and 90 miles respectively above Akyab. Many of the other rivers which fall into the Bay of Bengal are similarly navigable for some miles above the seaboard, and native craft can of course proceed much farther inland. Farther east the great Irrawaddy river, which traverses nearly the whole length of Upper and Lower Burma (excluding Tenasserim), is navigable by steamers at all seasons of the year as high as Bhamo, or more than 500 miles from its mouth, and steam launches and country boats can proceed much higher, or for some distance to the north of Myitkyinā. The numerous deltaic channels which fall into the Bay of Bengal from the Irrawaddy form waterways connected with the main river and with the sea, which are for the most part navigable throughout the year, while higher up many of the tributaries of this river are navigable for some distance above their confluences. Of these the two most important are the Chindwin and Myitnge rivers, the former of which is navigable by steamers during the monsoon as high as Homalin in the twenty-fifth parallel of latitude,

and by smaller craft as far as Kyaukse. Farther east again are the Sittang and the Salween rivers, both of which discharge into the Gulf of Martaban. The former of these is navigable by small steamers during the monsoon as far as Toungoo, and for small craft as far as Pyinmanā in Upper Burma. All these rivers have numerous navigable affluents, and branches or mouths which spread fanlike over their deltas and are in navigable communication with each other. There are also, all round the Burma coast, innumerable creeks and backwaters open to steamers or smaller craft.

Navigation dues.

The tolls charged for navigation vary very much on different works, and cannot be easily compared. In the United Provinces and the Punjab monthly or quarterly charges are made according to the size of the boat, which is then free of the canal during the period for which the pass is given. On the Fuleli Canal in Sind the same system is adopted. In Bengal the charge depends on the maundage, which is taken roughly as half the displacement measured in cubic feet. There are fixed rates per 100 maunds for different reaches, which vary with the length and other circumstances. In Madras the Bengal system of distance-tolls on all vessels plying between certain stations was originally in force; but has been replaced by a system of annual and short-term (6 weeks) licences, for which moderate fees are charged, and which leave the holders free to navigate all parts of the connected waterway systems. In Burma navigation tolls are levied only on the Pegu-Sittang Canal, where they are charged on the carrying capacity of the boats expressed in baskets of paddy ('unhusked rice'), and on the Shwetachaung Canal in Mandalay District, which is navigable for about 13 miles. Conservancy or registration fees are sometimes charged on vessels navigating the large rivers. On the Indus the charge is at the rate of Rs. 4 per annum per maund of registered burden for native craft, while steamers which pay no port dues are charged three times this amount.

Navigable canals compared with railways.

The comparative merits of railways and navigable canals as means of communication have sometimes been discussed. The principal argument in favour of the latter is that the cost of haulage or transport is less. On the other hand, canal routes are more devious; cross-communications or connexions between different systems are more difficult; feeder canals cannot be taken into new areas of supply with the same facility as feeder railways; the time occupied in transport on canals is much greater; and, lastly, there are many tracts in

which canal navigation cannot be maintained, even at great expense, without the diversion and absorption of a large volume of water which might be more advantageously used for irrigation. The comparison of these advantages and disadvantages is, however, only of academical interest. The commercial, the administrative, the military, and even the agricultural needs of India could never have been met by means of navigable canals alone; and the real question is not of the comparative merits of canals and railways, but whether in particular cases navigation canals may not suffice for immediate requirements, or may not serve as useful supplements to railway facilities already provided. Individual cases of this kind must be considered on their merits, but it is noteworthy that there is hardly a single tract in which navigable canals have been made by Government in which a railway has not been subsequently constructed. There may be now, or eventually, room for both, but the fact that the construction of a railway causes a very serious diminution in the volume of previous canal traffic indicates that the lower cost of haulage on canals cannot in many cases be set against the other advantages which may be claimed for railways. It may be said that during the severest stress of recent famines railways have sometimes failed for a time to cope fully with the situation, but this has been generally due to the want of a reserve of rolling stock, and navigation canals would be equally liable to failure from insufficiency of cargo boats. It is, indeed, difficult to conceive any practicable system of navigable canals by which the exigencies of famine-distressed districts could have been met as effectively as by the existing network of railways. Lastly, it may be said that, whatever the comparative capital cost of navigable canals and railways may be, the former have never proved directly remunerative, whereas the latter yield on the whole a net revenue which is more than sufficient to cover all the interest charges on their capital cost. Much can, no doubt, still be done for the improvement of communications in the deltas of Eastern Bengal and similar areas by improving the open waterways of the country and connecting them by navigable cuts, but outside these tracts the field for the extension of inland navigation cannot be regarded as either wide or promising.

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Bibliography

A. Deakin.—*Irrigated India* (1893).

R. B. Buckley.—*Irrigation Works in India and Egypt* (1893).

J. and R. Strachey.—*Finances and Public Works of India* (1882).

Report of the Irrigation Commission, 1903.

Reports of the Famine Commissions of 1878–80, 1898, and 1901.

Annual Irrigation Reviews of Government of India and Local Governments.

'Completion Reports' are also published, under the authority of the Government of India, for each Major irrigation work when completed.

CHAPTER VII

RAILWAYS AND ROADS

Railways

RAILWAYS had been working in England for several years before any steps were taken to construct them in India, and it was not until 1845 that the first reference was made on the subject by the Court of Directors. In that year applications received by the Court from private parties for co-operation in opening railways on an extensive scale in different parts of India were sent to the Governor-General for report, with the opinion that the enterprise would only be profitable where proportionately large returns could be obtained to meet the great expense of construction and working. The Court considered that, independently of the difficulties common to railways in all countries, India would present special and peculiar obstacles, such as floods, storms, damage by insects and by the luxuriant tropical vegetation, and the difficulty and expense of securing the services of competent engineers. So doubtful were they of the feasibility of the proposals that they recommended that the first attempt should be made on a limited scale. Introductory.

As a result of this reference, contracts for the construction of experimental lines were entered into with the East Indian Railway Company, for a line from Calcutta (Howrah) to Rānīganj (120 miles); with the Great Indian Peninsula Railway Company, for a line from Bombay to Kalyān (33 miles); and with the Madras Railway Company, for a line from Madras to Arkonam (39 miles). Early lines projected.

Later, the Directors began to realize that, without the material appliances which facilitate and cheapen the means of communication and production, there could be no rapid progress in the country either morally or materially, or in the efficiency of the administration; and they expressed the wish that India should, without unnecessary loss of time, possess the immense advantage of a regular system of railway communication.

Lord Dalhousie's Minute.

The question was reviewed by Lord Dalhousie in an exhaustive minute written in 1853. He urged the importance of a speedy and wide introduction of railway communications throughout India; he pointed out the great social, political, and commercial advantages of constructing railways between the chief cities; and he specially recommended that, in the first instance, a system of trunk lines should be formed, connecting the interior of each Presidency with its principal port and the several Presidencies with each other. The trunk lines proposed were: a line from Calcutta to Lahore; a line from Bombay to some point in Hindustān, or alternatively a line by the Narbadā valley to meet at some point the line from Calcutta to Lahore; a line uniting Bombay and Madras; and a line from Madras to the Malabar coast.

Trunk lines projected.

The Court of Directors accepted the general plan proposed; and by the end of 1859 eight companies[1] had been formed for the construction of nearly 5,000 miles of line, with a capital under guarantee of £52,500,000 sterling. Thus was laid the foundation of the system of railways now existing in India, which amounted on June 30, 1905, to 28,054 miles, and which, radiating from the ports of Calcutta, Bombay, Madras, Karāchi, Chittagong, and Rangoon, literally extends throughout the length and breadth of India, and connects, or is in process of connecting, every city of any importance and every Province.

A few trunk lines, notably the Bombay-Sind, the Bengal-Assam, the Assam-Burma, the north and south broad-gauge connexions, and the linking up of the metre-gauge systems of Northern, Central, and Southern India, still remain to be constructed; some large tracts of country have not yet been opened up by railways; and many railways require feeder lines. All these projects are now being taken in hand, in the order of their importance, as funds become available. During the six years ending 1905, the length opened for traffic was 6,014 miles, or considerably more than was added during any similar period. But even at this rate the development of railway communications is regarded by many as not so rapid as the circumstances of the country require and would justify. The hindrance to a quicker expansion has been mainly financial.

[1] (1) The East Indian; (2) the Great Indian Peninsula; (3) the Madras; (4) the Bombay, Baroda, and Central India; (5) the Eastern Bengal; (6) the Indian Branch, now the Oudh and Rohilkhand; (7) the Sind, Punjab, and Delhi, now merged in the North-Western State Railway; and (8) the Great Southern of India, now the South Indian Railway.

All the original applicants for concessions for the promotion of railways demanded that a mininum return should be guaranteed by the Government on their capital; and as companies could not be promoted without this condition, a guarantee of 5 per cent. was eventually agreed to, coupled with the free grant of all land needed. In return, the companies were required to share surplus profits half-yearly with the Government after the guaranteed interest for the half-year had been met, exchange for the remittance of interest charges being reckoned at *22d.* to the rupee; to sell their railways to the Government after 25 years, at a rate specified; and to permit the Government to exercise the closest control over all expenditure and over the management and working of the line. These conditions would have been favourable to the Government if the guarantee had been earned. But all expectations in regard to profits were destroyed by the heavy outlay on the construction of the lines. The science of construction had not reached a high state of development, and the general idea seems to have been that railways could not be efficiently managed unless they were built to a standard which was far in excess of the needs of the time. There were no engineers in India qualified to construct railways, and men had to be procured from England, who were necessarily ignorant of the country, its conditions, and its language. They had neither experience of India, nor history to guide them; and there was no organization of labour in existence for works of such magnitude. They had, consequently, to learn by practical experiment what to avoid and what to adopt.

Financing of railways.

Adoption of guarantee system.

The Government officers in India on whom fell the duty of criticism of schemes, approval of works, and general control over expenditure, were themselves unfamiliar with railway practice. They could not therefore render any professional assistance to the engineers; and their supervision and control was carried to a degree of minuteness which led to the appointment of a Committee of the House of Commons in 1857–8 to inquire into the delays alleged to have occurred in the construction of Indian railways.

Delay in progress.

The difficulties were reflected in the work done. The standard of construction was far higher than required for the conditions of the country, or for the actual work which the railways were designed to perform. Conveniences were provided which, while in themselves desirable, were unnecessary for the safe or efficient operation of the railway; and the experimental lines were built with a double track, the necessity for

Reasons for high cost.

which did not arise till a generation later. A further increase in the cost of construction was caused by alterations in the routes after work had been actually commenced. The outbreak of the Mutiny in 1857 added to the burden, by throwing everything into confusion and causing the suspension of all work for a time. Consequently, the earnings, which might have been sufficient to pay interest charges on a reasonable expenditure, proved inadequate to meet the guarantee on the outlay actually incurred, and Government had to make good the deficit.

Loss due to method of sharing profits.

Later, when business had developed and the earnings for the whole year were sufficient to cover the interest charges, the operation of the clause in the contract requiring surplus profits to be divided half-yearly deprived Government of the benefits of the first half of each year, when traffic is always much higher than in the second half, and left a deficit on the whole year's transactions.

Further extension of railway systems.

The Mutiny brought the strongest possible proof of the necessity for improved means of communication. Several efforts were made to get schemes promoted by unassisted private enterprise; but money for railways in India was not obtainable in London without some form of Government guarantee, and in every case the Secretary of State had eventually to guarantee, as in the previous cases, a minimum dividend of 5 per cent. As these railways were brought to completion, and failed to earn the guaranteed interest, the deficit to be met by the Government kept increasing in amount, until it reached the large sum of 166½ lakhs in the year 1868–9.

Improvement in trade in consequence of railways.

While, however, the deficit on the railway account was large, the trade and revenues of the country testified to the value of the new means of communication which had been provided. In 1851–2, the year before the first railway was opened, the total value of the export and import trade amounted to 32 crores, and prior to the introduction of railways had varied very little from year to year. After their introduction, the value of foreign trade kept steadily progressing until in 1868–9, when 4,008 miles of railway were open, it had risen to 89 crores, or more than double what it was before railways afforded cheap and easy transport. An improvement in general revenues accompanied the improvement in trade. These solid advantages fully justified the decision of Lord Dalhousie's Government and more than compensated for the financial loss arising out of the guarantee; and if the country had been financially prosperous at the time, perhaps undue weight would not have been attached to the deficits in railway earnings.

But there had recently been a general rise in prices and wages, and every branch of the service required money for necessary improvements in administration; the situation was further aggravated by the Orissa famine of 1865–7, followed by the prolonged drought in the United Provinces and Rājputāna in 1868–70, and it was found impossible to maintain financial equilibrium. The increasing demands for guaranteed interest, therefore, proved extremely inconvenient, and the whole guarantee system fell into disrepute. Private enterprise still held aloof from railway projects without a guarantee. The provision of railway communication was consequently not keeping pace with the increasing requirements of the country, the progress during the preceding ten years having averaged less than 350 miles of new line each year. The guaranteed railways, it was considered, had cost a great deal more than necessary, because of the absence of any incentive to keep down expenditure; and the Government of India believed that railways could be more cheaply constructed and more economically worked by the direct agency of the state, while money could be borrowed at a lower rate than was paid under the guarantee. Proposals, therefore, were made in 1867 to introduce this latter method, but were not accepted by the Secretary of State. In 1869 the Government of India again pressed its suggestion, and obtained sanction to the discontinuance of the guarantee system and to the introduction of a state railway scheme.

Discredit of guarantee system.

The charge on the revenues of India under the guarantee system then amounted to about £1,500,000 sterling, and it was considered that £2,000,000 might be appropriated annually for railway extension by direct Government construction. The guaranteed railways, which had been constructed on a gauge of 5 ft. 6 inches, had cost about £17,000 a mile, and at this rate it was realized that progress could not be very rapid. It was, therefore, decided to build the state railways on the metre gauge; but it was found that progress was still not rapid enough, and in 1875 the amount to be spent annually on railways was increased to four crores. But soon afterwards, war and famine reduced the funds available; and a great part of the expenditure was devoted to the conversion, for strategic reasons, of the recently begun Indus Valley and Punjab Northern State Railways from the metre gauge to the standard of the lines which lay between them and the rest of India. Application had, therefore, again to be made to companies to construct railways under a guarantee. The system now adopted was distinguished from the old guarantee and the

Allotment of funds for state railways.

state railway systems, and the lines promoted were called 'State Lines worked by companies,' but practically the only difference between these and the old guaranteed companies was that the terms were easier for the Government. The lines so promoted were the Indian Midland (1882-5), now merged in the Great Indian Peninsula, the Bengal-Nāgpur (1883-7), the Southern Mahratta (1882), and the Assam-Bengal (1891) Railways; with a total length exceeding 4,000 miles.

Limit to debt.

By 1879, the continued fall in the gold value of silver and the series of famines between 1874 and 1878 had so disturbed the financial position of the Government, that the question of providing funds for the construction of railways in India was referred to a Committee of the House of Commons. This Committee advised that the total to be borrowed in any year for both railway and irrigation projects should be limited to the amount which could be raised in India without unduly depressing the market: a total that was estimated at 2½ crores, of which 2 crores was assigned to railways. It was obvious that not much progress could be made with so small an outlay, and the Government again endeavoured to attract unaided private enterprise, but the results were not encouraging. Four companies were promoted: namely, the Nīlgiri, the Delhi-Umballa-Kālka, the Bengal Central, and the Bengal and North-Western Railways. The first of these became bankrupt, the second and third eventually received a guarantee, and the Tirhut State Railway had to be leased to the fourth. Native States were also invited to undertake the construction of railways in their territory independently of Government aid, and a commencement was made with the Nizām's State Railway, a length of 330 miles.

Increased provision of funds.

Up to the year 1870, when the first change in policy took effect, 4,255 miles had been opened for traffic, all except 45 miles being on the broad gauge. During the next ten years, that is, up to the end of 1879, there were added to the railway system 4,239 miles, making the total open for traffic 8,494 miles, of which 6,562 were on the broad gauge, 1,865 on the metre gauge, and 67 on narrower gauges. The famines of 1873-4 in Bihār and of 1876-8 in the Deccan had shown the necessity for a more rapid extension of railways than was possible, even with the adoption of narrow gauges, under the limit of loans to 2 crores a year. A portion of the Famine Insurance Grant[1], which was created about this time, when

[1] An explanation of the object and uses of this grant will be found in Vol. IV, chap. vi, Finance.

not required for direct famine relief, was made available for expenditure on railways of a protective or productive nature; but the sum thus contributed was never large, and progress continued slow. By 1883, however, the finances of the country had considerably improved, and a second Parliamentary Committee advised that the limit of borrowing might be increased. It was raised to $3\frac{1}{2}$ crores annually, of which about 3 crores was assigned to railways. This enabled quicker progress to be made for a time, but the Panjdeh incident in 1885 diverted funds to the construction of costly strategic and unremunerative railways on the north-west frontier. In 1890 the whole available balance of the Famine Insurance Grant was devoted to railway construction[1]; and in 1892 the Secretary of State sanctioned half a crore being specially added to capital expenditure, to enable companies to undertake new lines of railway and extensions with sums borrowed by Government.

Introduction of rebate terms in 1893.

As exchange continued to fall and had begun to affect seriously the finances of India, it became necessary for the Government to avoid increasing their gold liabilities, which necessarily rose so long as the construction of railways by state agency continued; and in 1893 another attempt was made to work through companies. But as a guarantee involved the same gold liability, a subsidy was offered instead. This took the form of a rebate or payment from the gross earnings of the main line from traffic interchanged with the company's line, so that the total profits of the company should yield a dividend of 4 per cent. The rebate was, however, limited to 10 per cent. of the gross earnings from such traffic. The only companies promoted under these conditions were the Ahmadābād-Parāntīj, the South Bihār, and the Southern Punjab, though in the case only of the first were the terms adhered to strictly. The Bārsi Light Railway, which was promoted at the same time, received no assistance from the Government except free land.

Revision of 1893 terms in 1896.

These conditions were found to be insufficiently attractive, and the terms were revised in 1896. Companies were now offered either an absolute guarantee of 3 per cent., with a share of surplus profits, or a rebate up to the full extent of the main line's net earnings in supplement of their own net earnings, the total being limited to $3\frac{1}{2}$ per cent. on the capital outlay. Under the first alternative, namely that of a guarantee, the

[1] Under present arrangements, expenditure in connexion with protective railways and irrigation works cannot exceed half the Famine Insurance Grant, i.e. 75 lakhs out of a total of $1\frac{1}{2}$ crores.

Hardwār-Dehra and the Brahmaputra-Sultānpur lines were promoted. Under the second alternative, or the rebate terms, the Mymensingh-Jagannāthganj, the Noākhāli, the Tāpti Valley, the Ahmadābād-Dholka lines, and the line from Amritsar through Tarn Taran to Patti, were promoted, though in none of these cases were the terms laid down followed. The Sagauli-Raxaul and the Kālka-Simla Railways were promoted at the same time without guarantee or rebate. Of these lines, the Brahmaputra-Sultānpur and the Sagauli-Raxaul have since been purchased by the Government, and the purchase of the Hardwār-Dehra, the Noākhāli, and the Kālka-Simla lines is under negotiation.

Failure to attract private enterprise.

Numerous applications have from time to time been received for the construction of railways by companies; and although the 1896 terms have been modified so as to make them as favourable as possible short of a direct guarantee, promoters are still unable to float their companies and one concession after another has lapsed. Projects for which a guarantee was promised have been equally unsuccessful, and the 1896 terms have proved no more attractive than those of 1893.

Raising of funds by Native States.

Some assistance has been obtained by Native States providing part or the whole of the funds required for railways passing through their territory. The money has in some cases been found from the revenues of the States, in others it has been lent to the States by the Government, and in others again the Government has guaranteed loans made to a State by a company. The system of branch railways in Baroda, portions of the Indian Midland Railway running through Bhopāl, the system of railways in Kāthiāwār, and portions of the North-Western Railway running through the Phulkiān States in the Punjab are instances of railways built with money provided from the revenues of the States named. For the Jodhpur-Bīkaner and the Cooch Behār Railways, the funds were lent to the Mārwār, Bīkaner, and Cooch Behār States by the Government of India. The system of railways in Mysore was constructed partly from funds provided by the State and partly from funds supplied by the Southern Mahratta Railway Company on the guarantee of the Government of India. The total length constructed in this way amounts to 3,422 miles; but no reliance can be placed on this method for a steady supply of funds for the development of the railway system.

Financing of railways by District Boards.

Efforts have been made to get lines of purely local importance financed by District Boards on the security of their local revenues, where these revenues are in a sufficiently flourishing

condition to remove the fear that the liability might involve the inhabitants of the area served in increased taxation, or might finally have to be passed on to the Government of India. Few boards have been able to take advantage of the arrangement, and only 158 miles of line have been provided on these terms, all in Bengal. In Madras, the value of railways as an important factor in the development of the Districts was more clearly realized; and legislation has provided that, on the initiation of a District Board (by a three-fourths majority), a special cess may be levied on all occupied lands which would be served by the railway or benefited by its construction, the proceeds to be devoted towards the provision of railways within the District. But as the collection of money must necessarily be a slow process, the Government offered, when a sufficient sum had been collected, to advance from the Provincial Loan Account, on the security of the entire resources of the District Board, such sums as might be required to allow of railway construction being immediately undertaken. So far only 105 miles of railway have been built under this arrangement (in the Tanjore District of Madras), but several small projects are maturing. Little relief to Imperial finances can, however, be expected from these sources, as the funds at the disposal of the District Boards can never be large. The Government is, therefore, at the present time, obliged to provide from its own resources the money for most of the railways which it wishes constructed.

Deficiency of funds for open lines.

The easier and cheaper means of transport afforded by railways, the opening of new lines, and the construction of feeder roads have added greatly to the business of the trunk lines. The need for the provision of improved facilities to cope with this increasing business has thus been steadily growing. While the allotment for railway expenditure was limited in amount and the demand for new lines all over the country was urgent, little money could be made available for expenditure on open lines, with the result that the latter were starved. The East Indian Railway, which, though worked by a company since its purchase in 1880, was treated as a state railway and had therefore to derive its funds from the state allotments, appealed to the Secretary of State for relief; and an Act of Parliament was passed in 1895 authorizing the company, with the approval of the Secretary of State, to raise capital for the construction of railways and works in extension of, or in connexion with, its own undertaking. The question how best to provide funds for a wider development of the

railway system was at the same time considered, and sanction was given in 1896–7 to an expenditure of 29⅔ crores spread over three years. But famine, frontier wars, and a falling exchange prevented the carrying out of this programe. Expenditure on railways had to be curtailed, and the power which had been given to the East Indian Railway Company to raise money for its own requirements independently of the Government became inoperative. The expenditure incurred on railways constructed by the agency of guaranteed companies had hitherto been kept apart from the Government allotments, and was not affected by the exigencies of the Government finances. The continued fall in exchange, however, made it necessary for the Government to take cognizance of all capital liabilities; and since 1896 the expenditure incurred, not only by railways owned, but also by those guaranteed, by the state has been included in the railway programme.

Method of allotting funds.

With the inclusion of all railways for which the Government was financially responsible in the programme, the capital budget allotments necessarily required to be increased. An improvement in exchange, in consequence of the closing of the mints to the free coinage of silver, made this possible, but a severe famine in Gujarāt and the Deccan in 1899–1900 again caused expenditure on railways to be curtailed. The position had now become acute. The development in both passenger and goods traffic required more rolling stock, larger stations and goods sheds, additional sidings and stations, and sometimes duplication of the permanent way. The increasing demand for a faster and better train service necessitated expenditure on interlocking plant and automatic brakes, if the safety of the travelling public was to receive due consideration. With a limited and varying programme, either the construction of new lines had to be stopped or work on open lines had to be deferred. A middle course was taken, and neither one nor the other received all the funds needed. The difficulties of the railways in properly conducting their business finally became so great that it was decided in 1901 to adopt the principle of regarding the needs of open lines to meet their growing traffic as a first charge upon the funds available; next in order provision is made for the steady prosecution and early completion of lines in progress, preference being given to companies' lines over those under construction by the agency of the state; and after these needs have been met, the claims of new lines are considered.

During the next five years, viz. 1901–6, the finances of the

country were in a flourishing condition; and the annual allotments for expenditure on railways kept increasing in amount, until in 1905–6 they reached $12\frac{1}{2}$ crores, the largest ever made in any one year, of which sum 558 lakhs were allotted for expenditure on open lines, 640 lakhs on lines under construction, and only 52 lakhs on new lines. The money was proposed to be obtained partly by borrowing (to the equivalent of £6,000,000 sterling) in London and India, partly by appropriations (£500,000) from the Famine Insurance Grant, and partly by utilization (£2,000,000) of surplus revenues and Savings Bank deposits.

Lack of funds continues.

The demands of open lines have so far never been fully satisfied, and the rapid development of traffic is emphasizing the need for facilities, all of which are costly, but the provision of which cannot be deferred much longer without injury to trade and without checking that development of the country which railways have themselves helped to promote. Open lines already absorb a large amount of capital annually, and their requirements are likely to increase as time goes on. Unless, therefore, some method can be found not only for keeping the programme at the figure which it has now reached but for considerably increasing it, the funds available for expenditure on new lines will be insufficient to satisfy the demands which come with increasing urgency from all parts of the country. It has now been determined, in connexion with the constitution of the Railway Board referred to on page 378, to give greater stability to railway construction by working out programmes three years in advance, and by re-allotting lapses on one year's programme (up to 50 lakhs) to the next.

Mileage still to be constructed.

The Government now (1905) has proposals before it for the construction of about 13,000 miles of railway, though this estimate by no means represents the total required to open up the country adequately. At the end of June, 1905, India had one mile of railway to every 63 square miles of country and to every 10,511 inhabitants; while the Russian Empire had, in 1902, one mile to every 232 square miles of country and to every 3,460 inhabitants. Much, therefore, still remains to be done to provide India with all the railway communication she needs. With the financial limitations placed on the Government of India, the problem of raising funds for the extension of the railway system is not easy of solution, though it has for some time been engaging attention.

Mileage constructed.

Notwithstanding these difficulties Government had succeeded in providing India, up to the end of June, 1905, with 28,054

miles of railway at a cost of 359 crores of rupees or £240,000,000 sterling. Of this total, 14,705 miles have been constructed by the state, 6,935 under the guarantee system, 3,574 by Native States, 1,459 by companies with assistance in some form or other but without a guarantee, 1,307 by companies without assistance other than free land, and 74 by foreign Governments. Some of the lines included under the head 'guaranteed' are shown in the accounts as state lines, though they were originally promoted under a guarantee, or subsequently received one. Of the original lines constructed under a guarantee, only two were worked in 1905 under their old contracts: the Bombay, Baroda, and Central India, which was acquired by the state at the end of that year; and the Madras Railway, the contract of which is terminable in 1907. The remaining old guaranteed lines have been purchased by the state: the East Indian in 1880; the Eastern Bengal in 1884; the Sind, Punjab, and Delhi in 1886; the Oudh and Rohilkhand in 1889; and the Great Indian Peninsula in 1900. Of these, the East Indian and the Great Indian Peninsula were again leased to companies to work, while the others were taken over and worked as state railways. On the other hand, many of the railways constructed and for some time worked by the state have been leased to companies or to lines owned and worked by Native States. The extent to which these transfers have been made are shown in the Appendix (pp. 415–17), where the railways are classified according to their gauge and the agencies by which they are now owned and worked. The Appendix also shows the dates on which the contracts of the principal guaranteed and state-aided lines are terminable.

Financial results to Government.

In purchasing these old guaranteed lines, payment was usually made in the form of terminable annuities, which became a charge against the revenues of the railways. As these annuities represent not only interest charges but also the amount payable in redemption of capital, the railway returns appear worse than they really are. The great development in traffic, however, which has been taking place during recent years, has counteracted this effect of the annuity charges; and, after payment of all working expenses, interest charges, annuity payments, and every other liability, the Government has, during each of the past five years, made a handsome profit from its railway property. In 1904 the profits amounted to 263¼ lakhs. That this satisfactory condition of railway finance will continue there can be little doubt. The construction of canals in the Punjab, and the colonization of the districts served by

them, have added so enormously to the traffic of the North-Western Railway as to convert it from an unremunerative line to one yielding large profits. The new mileage added from year to year to the railway system of India opens up new country, and the improvement in the means of communication develops resources and gives new business to the old lines, all of which are fast passing out of the stage when they require assistance from the general revenues to meet their interest charges.

Control by Government.

The clauses in the contract guaranteeing a definite rate of interest on their outlay to the companies which promoted the earlier railways, and reserving to the Government the right to purchase the undertaking after a specified period, necessitated some supervision and control over operations and expenditure during construction, and over management and expenditure after the lines were opened for traffic. For the exercise of this supervision and control Consulting Engineers were appointed, who were placed under the Local Governments. The rules laid down for their guidance were closely defined. All questions of general importance, and all works involving expenditure exceeding a certain fixed amount, were referred to the Government of India for decision; but after its orders had been obtained, the Consulting Engineer had full power to deal with details. All designs, estimates, and indents, whether for works or establishments, required his approval, and it was open to him to insist on the modification of any proposal made. The difficulties which arose in the exercise of these powers led to the appointment in 1857–8 of the Parliamentary Committee already referred to. It concluded its report by expressing the belief that a judicious adherence to the spirit rather than to the letter of the contracts was needed. The effect of the inquiry was distinctly beneficial. It improved the relations between the railway and the Government officers, and the conduct of business was expedited. The system introduced in 1849 has continued up to the present day, with this difference only, that the Consulting Engineers were removed in 1871 from the control of the Local Governments, except in the case of Madras, Bombay, and Burma, and placed directly under the Government of India.

Consulting Engineers.

Control by Government of India.

The history of the different methods by which the Government has exercised the control required by its interest in the railway system of India will be found in Vol. IV, chap. x. In 1897, when important changes had recently been completed, the organization of the Railway Branch of the Public

Works Department of the Government of India included an expert Secretary with three expert Deputies, one of whom was Director of Traffic, another Director of Construction, and the third Accountant-General.

Proposal for establishment of a Railway Board.

Nevertheless, it had long been felt that the organization of a Government secretariat was hardly qualified to give to the railway administration of so vast a continent as India the elasticity that was desirable, or to ensure sufficient attention being paid to the commercial aspects of railway policy. Further, the subordination of the Public Works Department to a Member of Council of the Civil Service did not provide adequately for the exercise of expert authority in the final decisions of Government. For many years a change of system had been advocated. It was reserved for Lord Curzon's Government to carry this into effect. Before proceeding to formulate any definite scheme, they sought the services of an English railway expert, Mr. Thomas Robertson, who spent the winters of 1901 and 1902 in studying the railways of India, and the summer of 1902 in studying the methods adopted in America. He then submitted a report, in which he recommended that the existing system should be replaced by a Railway Board, consisting of a chairman and two members with a secretary, on the ground that for the proper administration of railways a small body of practical business men was needed, to whom should be entrusted full authority to manage them on commercial principles, and who should be freed from non-essential restrictions and needlessly inelastic rules. He further submitted recommendations covering almost every aspect of railway administration, some of which are in course of being carried into effect.

Appointment of Railway Board.

The Railway Board was formally constituted in March, 1905. It has been placed outside of, but subordinate to, the Government of India, and is represented in the Viceroy's Council by the member in charge of the Department of Commerce and Industry. The duties assigned to the Railway Board are of two kinds. Its deliberative functions include the preparation of the railway programme of expenditure and the discussion of the greater questions of railway policy and economy affecting all lines, the final authority for decisions in regard to which is still retained by the Government of India. Its administrative duties include the construction of new lines by state agency, the carrying out of new works on open lines, the improvement of railway management with regard to both economy and public convenience, the arrangements for through traffic, the settlement of disputes between lines, the

control and promotion of the staff on state lines, and the general supervision over the working and expenditure of companies' lines. The final authority in regard to these administrative duties has been delegated, subject to restrictions, to the Railway Board.

The change thus inaugurated is the most important that has been made in policy and administration since railways were first introduced into India over fifty years ago. It cannot fail to result in the more rapid discharge of business and, with the increase of available funds that may be expected in the near future, in a more sustained and consistent policy of railway construction.

Management of railways. The earlier railways were all constructed by companies promoted in England, which were managed by a Board of Directors in London and were represented in India by an Agent. The Agent had under him a Traffic Manager, who held charge of the traffic department in both its transportation and commercial branches; a Chief Engineer, who was responsible for the maintenance of way and works; a Locomotive Superintendent, who was in charge of the locomotives and the mechanical department; a Storekeeper, who arranged for the supply and care of all stores; a Police Superintendent, who was appointed by the Government; and an Auditor, whose duty it was to audit and prepare the accounts of the company and to see that no expenditure was incurred without proper authority. The Traffic Manager, Chief Engineer, and Locomotive Superintendent had district officers under them, who were responsible for the departments in their respective charges. When the system of state railways was started, the Indian organization of companies' railways was followed by the Government, with slight changes in nomenclature.

This organization has been continued down to the present day. But the principle of consolidating several railway undertakings under one management, which has been so largely adopted in England and America, has been followed in India also; and this, added to the great development of business, has shown the need for some change in the system of administering the traffic department. On the larger railways the department is being split up into the two divisions under which it naturally falls: namely, commercial, or the procuring of traffic; and transportation, or the handling and haulage of traffic.

Clearing House. The increase in the volume of the traffic interchanged between railways has also led to a consideration of the manner

in which the accounts relating to such traffic should be kept. At present the work is done several times over, the audit office of every railway over which a consignment passes dealing with the document relating to it. Proposals have at various times been made for the establishment of a central clearing house, but the distances in India are so great that it has so far not been found possible to make any change in the existing methods.

Indian Railway Conference Association.

The numerous questions arising about railways in which uniformity of procedure is desirable, both as to domestic management and as to the carriage of, and the rates to be charged for, traffic passing from one system to another, led to the institution in 1876 of a Railway Conference under the presidency of an officer in the secretariat of the Government of India. This Conference was assembled only when the Government considered it necessary; and as the arrangement was not found satisfactory, it was decided in 1903 to form a permanent body, under the title of the Indian Railway Conference Association, and to place it under the direct control of the railways, who now appoint their own president from among the members. Much useful work has been done, and the new body is devoting its attention to many of the reforms necessary in railway management.

Gauge of railways: adoption of 5 feet 6 inches gauge.

When railways were first proposed for India, it was considered that a gauge wider than the English (4 ft. $8\frac{1}{2}$ inches) was desirable, as the narrower gauge would be inadequate against cyclonic storms, so frequent at certain seasons of the year, and a gauge of 6 feet was suggested. After much discussion a gauge of 5 feet 6 inches was decided upon and became the standard gauge for India. Proposals were subsequently made at different times for the adoption of a narrower gauge; but it was not till 1870, when the state railway system was adopted, and the financial condition of the country demanded some cheaper form of construction, that it was decided to adopt a narrower gauge for lines which were regarded as of secondary importance. The understanding was that such lines were only a temporary expedient, and were to be of the lightest and most economical description consistent with safety and the necessary degree of permanence. Stress was laid on their provisional character. They were not to compete with the system constructed on the standard gauge, and their cheapness was regarded as likely to obviate any possible difficulty in the way of a change of gauge when it had become expedient.

Adoption of the metre gauge.

As opinions differed as to the width which would be most suited to the wants of India, a committee of four engineers was appointed in 1870 to consider the question. They were not unanimous in their recommendations, three suggesting 2 ft. 9 inches and the fourth 3 ft. 6 inches. The question of adopting a metrical system of weights and measures in India was at the time under consideration, and the metre (3 ft. 3⅜ inches) was adopted as the gauge for the secondary lines.

The first lines proposed under this plan were the Indus Valley from Kotri to Multān and the Punjab Northern from Lahore to Peshāwar, both since merged in the North-Western State Railway. It was considered that a metre-gauge line would amply serve commercial and political demands in the northern and western portions of the Punjab, and would render all assistance to the movements of troops that could reasonably be desired. Later, the Rājputāna Railway from Delhi and Agra towards Ajmer, and the Holkar-Scindia Railway from Khandwā on the Great Indian Peninsula Railway to Indore in Central India, were projected. The Indus Valley and the Punjab Northern lines were subsequently converted to the broad gauge for military considerations. The Rājputāna and the Holkar-Scindia lines were completed on the metre gauge, and have since been merged in the Rājputāna-Mālwā State Railway, which is leased to the Bombay, Baroda, and Central India Railway Company.

In the construction of the earlier metre-gauge lines, the original idea of building them as light railways was followed; but the traffic which they were called upon to carry proved so much heavier and developed so much more rapidly than had been anticipated, that it was soon found that something more substantial must be provided if they were to fulfil their purpose. To increase the capacity of the metre gauge was a great deal less costly than to convert it to the broad gauge; and as funds continued scarce, the former course was adopted. These two factors, the cheapness of constructing metre-gauge lines, and the expense of converting them to the standard gauge, have exercised so great an influence on the policy of the Government, that it has seldom been found possible to adopt the original idea of converting the metre gauge as soon as the traffic justified the change. The consequence has been that the metre-gauge lines have been improved until their standard of construction and equipment is as good as on the broad gauge; and they have been extended until they occupy the whole of the country

north of the Ganges, Rājputāna and the western parts of Central India, Kāthiāwār, the Nizām's territory, the Southern Marāthā country and Mysore, Southern India, Assam, and Burma. All these were built as isolated lines. In 1892 the Southern Mahratta and South Indian Railways were connected at Dharmavaram; and in 1897 the railways north of the Ganges were linked up with the Rājputāna system, the latter being joined to the Kāthiāwār system in 1902; but these two groups are not at present connected with each other or with any of the other metre-gauge systems. The connexion between the lines north of the Ganges and the Assam system is now under construction; and a proposal is under consideration for linking up the Rājputāna system with the systems in the Nizām's territory and in Southern India. When this has been accomplished, the metre-gauge railways throughout India (excluding Burma) will be in direct connexion with each other.

Narrower gauges.

For thinly populated areas, and for short lines of purely local importance, a gauge narrower than the metre gauge has always been recognized as most suitable for developing the resources of the country. Opinion as to the proper width for these lines has varied a good deal, and 939 miles have been constructed on the 2 ft. 6 inches gauge and 327 miles on the 2 feet gauge.

Necessity for uniformity of gauge.

It is recognized that a break of gauge is a drawback always, and that during periods of pressure such as arise in the export season, at times of famine, and during extensive military movements, it is extremely inconvenient; but the evil has reached such dimensions—at the end of June, 1905, there were open for traffic 11,850 miles of metre-gauge railway, as compared with 14,938 miles on the 5 ft. 6 inches gauge—that the remedy is not simple.

Experience in America.

The same difficulty formerly existed in America, where there were six principal, to say nothing of minor, gauges. Conversion to a uniform gauge was there comparatively easy, because of the almost universal use of the bogie type of vehicle, the body of which can be transferred from the wheels of one gauge to those of another; and for many years transhipment of the contents of vehicles, both passenger and goods, was avoided by adopting this expedient. But, as the country developed, the inconvenience and delay resulting from break of gauge became intolerable. The vehicles were already interchangeable, and all new engines were built so that they could be run on a narrow or wide gauge. By 1886 arrangements were complete; and in that year some 13,000 miles of main track and 1,500

miles of siding were converted to the standard gauge of 4 ft. 8½ inches, the whole operation taking two days.

In India the problem is not so easy at the present time. There are few vehicles of the bogie type; and even if there were more, before the bodies of broad-gauge vehicles could be run on the metre gauge, extensive alterations involving large expenditure would be necessary in the fixed structures, which are all of the most substantial kind. The question has often been considered, but financial considerations have so far prevented any definite action being taken towards securing uniformity of gauge.

Difficulty of applying remedy in India.

In carrying out the earlier railways, more attention appears to have been paid to directness of alignment than to ensuring that the railway should adequately serve the trade centres on the route, and numerous large towns were left on one side, when by a slight diversion the railway might have been brought to the doors of the people. This policy has had a most injurious effect on the revenues of the railways. The lines themselves were constructed after the best methods then known in England, with the result that they not only cost a great deal more than the circumstances justified, but have involved much expenditure afterwards when traffic developed and alterations at stations became necessary. The buildings were all of the most substantial kind, and the permanent way consisted of heavy iron rails of the double-headed type, weighing from 68 to 84 lb. to the lineal yard, laid in cast-iron chairs secured to wooden sleepers. Steel rails have since superseded iron, but the weight on the broad-gauge lines remains very much the same. On the metre-gauge lines the rails do not weigh more than 50 lb. to the lineal yard. On many of the broad-gauge lines metal sleepers have replaced wood, though the latter material is still in general use on the metre and narrow-gauge lines. The wood used for sleepers is generally *deodār* or *pyingado*, but Australian hard-woods are coming into use. On bridges and at points and crossings the sleepers are almost entirely of *sāl* wood.

Character of construction.

In constructing the railways, steep grades and sharp curves were avoided; but when economy in construction became important, the alignment which would cost least was adopted regardless of curves and grades. In hilly country, such as that traversed in rising from Bombay to the Deccan plateau (Bor and Thal ghāts), and in passing from Sind to Baluchistān over the Bolān Pass, careful consideration had to be given to both curves and gradients to make the line possible for locomotive

traction. The route lay along the side of precipitous hills, and much skill was required in alignment and in carrying out the work subsequently. Many tunnels had to be provided, and one on the North-Western Railway (the Khojak) is $2\frac{1}{2}$ miles in length, being the longest in Asia. India is a country of large rivers, and the railways cross many of these, several of the bridges being more than half a mile in length, and a few exceeding a mile. In Northern India some of the rivers have been a great anxiety to the railway engineers. Much money has been spent in protective works; but the course of the rivers is constantly changing, and it is very difficult to train a river to take any definite channel. The bridges over the Hooghly near Naihāti, and over the Indus at Sukkur, are of the cantilever type, and the latter, at the time of its construction, had the longest rigid span in the world. The bridges are mostly built of iron or steel on masonry piers, though there are some pile bridges.

Coaching stock.

The coaching stock on Indian railways is chiefly of the four-wheeled type, but bogie carriages are now being extensively adopted. There are three classes on all railways, first, second, and third, and on some a class intermediate between the last two. The first and second-class carriages are well finished, and are provided with retiring accommodation in each compartment. The third and intermediate classes have usually lateral seats, and are seldom provided with such accommodation; but orders have recently been issued requiring its adoption in all carriages which are used on any but short local services. The development of the traffic has been so rapid and the scarcity of funds so great that most of the railways have an insufficient supply of stock, and in times of native fairs goods wagons have to be used extensively for the conveyance of third-class passengers.

Goods stock.

The broad-gauge wagons followed the English practice, being of the four-wheeled type, with side buffers and of light carrying capacity. When the metre gauge was introduced, side buffers were not used in the metre-gauge vehicles, and the American type of central coupling was adopted. The bogie wagon on eight wheels was at the same time introduced. As knowledge of railway management improved, the economy of increasing the carrying capacity of wagons as compared with their tare or dead weight was realized; and much attention has been devoted to the question, with the result that, while the weight carried by the best type of four-wheeled goods wagon in 1880 was, on the broad gauge, 10 tons, and on the metre gauge 5 tons, by 1904 it had risen to $15\frac{3}{4}$ tons on the former,

and to 10 tons on the latter. To the development of the four-wheeled wagon, however, there is a limit; and in America it has been entirely superseded by the eight-wheeled or bogie waggon, the most modern type of which has a capacity of 50 tons, with a tare of 17·3 tons. In India the full advantages of the bogie type have never been appreciated, and its few drawbacks have prevented its more extensive adoption. Owing to lack of funds, the supply of goods stock in India has not kept pace with the development of traffic; and during the busy season, when export is at its height, it is impossible to meet all demands promptly, and complaints are made every year, especially by the coal trade. Larger allotments of funds are now being made annually for rolling stock, and the supply is being brought up to the demand as quickly as the stock can be constructed.

Engines.

Like the wagons, the engines have followed the English practice, and are based on English design. While there has been much improvement in their hauling capacity, engines of power suitable to the heavy goods traffic of the country cannot be introduced, because of the limitations placed on axle loads so as to keep them within the carrying power of the bridges. These restrictions affect the average loads in goods trains. The best results on broad-gauge lines are obtained on the Bombay, Baroda, and Central India Railway, where the load averages 266 tons (on the metre-gauge line Rājputāna-Mālwā Railway, worked by the same company, it averages 135½ tons), compared with 518 tons on the 4 ft. 8½ inches gauge Pennsylvania Railway in America. Much has been done in India to improve the average load by better management; but really economical loads can be obtained only by following the American practice of employing wagons of greater carrying capacity and more powerful engines, and these cannot be introduced until the road has been strengthened.

Economic effect of railways.

Passenger traffic.

When the idea of constructing railways in India was first started, it was considered that there would be little passenger traffic on account of the poverty of the people, and that the chief business would be derived from goods. It was not realized how important a part pilgrimages to the numerous sacred shrines and rivers all over India play in the daily life of the population. Before railways were open pilgrimages occupied months and absorbed the savings of a lifetime. A trip to Purī or Hardwār, or any other of the popular Hindu shrines, is no longer a formidable undertaking. The cost is comparatively trifling, and the journey involves an absence from home of only a few days. No religious festival is now held without bringing, often from very long distances, thousands of devotees

to the several shrines. Even Mecca has been brought within easier reach of the faithful; and large numbers of Muhammadans, not only from India but also from Central Asia, now undertake the pilgrimage, which before was possible only for the wealthy. Another factor overlooked was that cheap, easy, and quick communications would enable the surplus population in congested areas to move to the more sparsely populated parts of the country, where labour alone was needed to make the soil yield bountiful harvests. Thousands now travel annually to the jute-fields and tea-gardens of Eastern Bengal and Assam, the rice-swamps of Burma, and other parts of the country; and distance no longer hinders the movement of the people. The greater the extension of the railway system, the more marked has this movement been; and the passenger traffic contributes to the business of railways to a very much larger extent than was anticipated. The development has been in all classes; but the principal increase has been in third-class passengers, of whom nearly 200,000,000 were carried in 1904 at an average rate of 2·34 pies (or 0·195 of a penny) per mile, yielding a revenue of 990 lakhs. The other classes brought the total number of passengers up to 227,000,000, and the total passenger earnings to 1176 lakhs.

Goods traffic.

In a country which is almost entirely agricultural, and with distances so great as in India, the principal traffic of railways must necessarily be in goods. Before railways were made, the cultivator derived little benefit from an abundant harvest. His markets were confined to a small area; and if the supply was greater than the demand, as it would be in a good season, prices fell, and he was deprived of the profits from the larger yield and often found it more economical to leave part of his crop uncut. Railways have altered these conditions. The improvement in communications has equalized prices in the case of agricultural produce within reasonable distance from a railway. When harvests are abundant, food-stuffs no longer rot for want of buyers, since the farmer has access to all the markets of the world. The development in goods traffic has consequently been even more marked than in the case of passenger traffic. The total quantity of goods carried in 1904 was 52,000,000 tons, and the income derived from it was 25 crores, the average rate charged per ton per mile being 5·39 pies (or 0·46 of a penny). The traffic consists chiefly of grain and seeds (12,361,000 tons), coal (9,397,000 tons), cotton (1,584,000 tons), jute (1,500,000 tons), salt (1,647,000 tons), sugar (1,447,000 tons), and timber (1,250,000 tons). All this traffic

was in country produce. A large part of the grain and seeds, cotton, and jute is exported; but the rest remains in the country, and the extent to which it circulates between different places may be judged by the fact that the distance each ton of goods was carried, reckoning the distance travelled over each railway as a separate journey, averaged 172½ miles. The greatest development in recent years has been in the coal traffic. The principal collieries are situated in Bengal, and they are practically the only local source of supply for all Northern, Western, and Central India. For some time movement was prevented by high rates, and these regions found it cheaper to import from England; but the reductions made in recent years have caused the almost complete displacement of English coal by Indian. Except in the neighbourhood of the collieries, coal is still too expensive for domestic use by the natives, but further large reductions in the rates for coal are in contemplation.

The development of local products, with a corresponding increase in the wealth of the people, has led to a greater demand for manufactured goods from foreign countries, and a marked increase in the import trade accompanies the extension of the railway system. Import trade.

For the working of railways a large staff is required, the number employed in 1904 being 422,000 persons, of whom 407,000 were Indians and 15,000 Europeans or Eurasians, 13,000 of the latter being enrolled as volunteers. This does not, however, represent the total number that depend on railways for their livelihood, as it excludes all contractors and their labourers and all daily-paid employés. On every railway, workshops are maintained which afford occupation to a large number of mechanics, and on the larger systems these workshops are very extensive. No railway at present undertakes to build its engines and wagons complete from start to finish. The parts come out from England, and are only put together in India. But the East Indian and Rājputāna-Mālwā Railways have begun to make their operations include complete construction, and the other large railways are moving in the same direction. Staff employed.

While the benefits conferred by railways are at all times great, their value is most realized during periods of famine. Famine is never universal throughout India; for when one area is suffering, another is likely to have an abundant harvest, and railways have made it possible for the deficiencies of the former to be supplied from the surplus of the latter. The word Effect of railways on famine.

famine no longer means scarcity of food. It now means only scarcity of money to buy food, which is always less difficult to meet. During the twelve months ending September 30, 1900, food-grains to the extent of nearly 2,500,000 tons were imported by the affected areas, which in ordinary years export about 250,000 tons. But for the railways, it would not have been possible to effect such vast movements of grain. The importance of good communications as a means of mitigating the suffering caused by famine is well illustrated by the history of the Orissa famine of 1865–6, when ships laden with grain were prevented by the winds of the south-west monsoon from leaving Calcutta, and it was impossible to supply food to the starving people.

Moral effect of railways.

It is less easy to gauge the moral influence which railways have exercised on the habits and customs of the people. It is often said that they are helping to break down caste; but it is doubted by many, whose opinions are entitled to respect, whether there has been any weakening of caste prejudices among the orthodox. There can, however, be little doubt that increased travel, and the mixing of all castes in carriages which railway travel necessitates, must produce greater tolerance, if it does no more.

Important lines.

The 28,054 miles of railway open on June 30, 1905, are worked as thirty-three separate undertakings, of which the most important are described below. Further statistics will be found in the Appendix (pp. 411–17).

Assam-Bengal Railway.

The Assam-Bengal Railway, which is constructed on the metre gauge, starts from Chittagong and runs through the Surmā valley and across the North Cāchār hills into Assam. It is worked under a limited guarantee by a company whose contract is terminable in 1921. The railway is not at present connected with the other systems of India, but a line is under construction between Dhubri and Gauhāti to link it up with the Eastern Bengal State Railway. It is 740 miles long, and has been very costly to construct on account of the section across the North Cāchār hills. The country through which it passes is very sparsely populated, and much of the labour required for its construction had to be imported. The railway was only completed in March, 1903, so that there has been little time to work up a business; and in 1904 the loss to the Government on account of interest charges amounted to more than 40½ lakhs. Efforts are, however, being made to encourage traffic by improving the port of Chittagong and by arranging for direct shipments from that port to Europe. These

measures and the connexion of the line with the Eastern Bengal State Railway will improve its revenues, but there seems little prospect of its ever paying its way until the system is largely extended by the addition of feeder lines. The number of passengers carried in 1904 was 2,219,000, of whom 2,187,000 were of the third class. The quantity of goods carried was 361,000 tons, consisting principally of jute, rice, and tea.

The Bengal and North-Western Railway was constructed on the metre gauge by a company, without any Government assistance other than free land, and was opened to traffic in 1885. The system as it exists at present was begun in 1874, as the Tirhut State Railway, by the construction of a line from Muzaffarpur to the left bank of the Ganges opposite Mokameh Ghāt, the river station on the East Indian Railway. In 1890 this line was leased by Government to the Bengal and North-Western Railway Company. Since then extensive additions have been made to both sections of the railway; and at the end of June, 1905, the system consisted of 1,468 miles, occupying the whole country north of the Ganges between the Gogra and the Kosi. At several points on the Ganges traffic is exchanged with the East Indian Railway, usually by steamers; but at Semaria and Barari Ghāts there are ferries, on which wagons are brought across the river to the East Indian Railway at Mokameh and Bhāgalpur Ghāts. For many years the system was entirely isolated; but in 1897 it was connected with the Rājputāna metre-gauge system at Cawnpore, and in 1901 with the Eastern Bengal State Railway at Katihār. It has since been connected with the Oudh and Rohilkhand Railway at Benares, Jaunpur, and Shāhganj; and a proposal is under consideration for its extension to Allahābād via Benares. The districts traversed by the system are among the most fertile and populous in India, and make good the deficiencies in the labour supply of other parts. The total number of passengers carried in 1904 amounted to 13,000,000, of whom 12,500,000 were of the third class. The quantity of goods carried was 1,750,000 tons, consisting chiefly of rice, grain, sugar (raw), seeds, opium, and indigo. The railway was constructed cheaply. It has always been very economically worked, and is one of the most successful undertakings in India. The contract is terminable in 1932, but the lease of the Tirhut State Railway may be determined in 1919.

Bengal and North-Western Railway.

The Bengal-Nāgpur Railway was commenced as a metre-gauge line from Nāgpur to Chhattīsgarh in the Central Provinces. In 1887 a company was formed under a guarantee,

Bengal-Nāgpur Railway.

which took over the line, converted it to the broad gauge, and extended it to Howrah, Cuttack, and Katnī. In 1901 a part of the East Coast State Railway from Cuttack to Vizagapatam was transferred to it, and in the same year sanction was given for an extension to the Jherriā coal-fields and for a connexion with the grand chord of the East Indian Railway at Hariharpur. This portion of the system is on the broad gauge, and is 1,696 miles long; but there are also 343 miles on the 2 ft. 6 inches gauge, and 275 more miles on the latter gauge are now under construction. The line is laid with single track throughout, except for 69 miles out of Howrah. It is separated from the town and port of Calcutta by the river Hooghly; but the physical breach has been overcome, so far as goods traffic is concerned, by a ferry which takes the wagons across the river without breaking bulk. The line runs through the Central Provinces and Western and Southern Bengal, and has always been in competition with the East Indian and Great Indian Peninsula systems. It affords the shortest route between Calcutta and Bombay; but the greater part of the line passes through sparsely populated country, and its passenger traffic would not be heavy but for the town of Purī, situated on the East Coast section, which draws thousands of pilgrims annually to the sacred shrine of Jagannāth. The total number of passengers carried in 1904 was 7,750,000, of whom 7,250,000 were of the third class. The goods traffic amounted to 3,250,000 tons. Until 1905, although the railway had access to some of the coal-fields in Bengal, the shortest route from them to Calcutta lay over the East Indian Railway, and under the rates prescribed by Government the traffic passed by that route and yielded very little revenue to the Bengal-Nāgpur Railway. In 1905 an agreement was come to with the East Indian Railway equalizing rates by both routes, and permitting traffic originating on the Bengal-Nāgpur Railway to be carried by that route to Calcutta. The effect on the revenues of the Bengal-Nāgpur Railway has been very marked. Until 1904 it had always been worked at a loss to the state, but in that year there was a small surplus. The earnings in the first half of 1905 have been large; and with the additional revenue that will now be obtained from the coal traffic, there seem prospects of the line ceasing to be a burden on the general revenues of the country. Besides coal, of which 1,250,000 tons were carried in 1904, the traffic consists chiefly of cotton, tanning barks, grain and seeds, jute, metals, oil, salt, stone, and timber. Iron ore in considerable quantities has recently

been discovered at Gurmashini in the neighbourhood of the railway, and proposals are now before Government for the construction of large iron-works and a railway to serve the mines.

Bombay, Baroda, and Central India Railway.

The Bombay, Baroda, and Central India Railway is one of the original guaranteed railways. It was commenced in the first instance from Surat via Baroda to Ahmadābād, but was subsequently extended to Bombay. The original contract was terminable in 1880; but the period was extended to 1905, on the condition that the line was continued to Viramgām to serve the Khārāghoda salt-works and to Wadhwān to serve the Native States of Kāthiāwār, conditions which were duly fulfilled. This portion of the system was constructed on the broad gauge and is 504 miles long, of which 251 miles are double line. In 1885 the Rājputāna-Mālwā metre-gauge system of state railways was leased to the company. Several additions have since been made by the lease of branches and extensions constructed by the Government, by Native States, and by companies independent of the parent line; and at the end of June, 1905, the undertaking consisted of 868 miles on the broad gauge, 2,022 on the metre gauge, and 132 on narrower gauges: a total of 3,022 miles, which makes it the second longest system in India under one management. The line, beginning at Bombay, runs north along the west coast to Viramgām, with branches on the broad gauge from Surat to Amalner on the Great Indian Peninsula Railway (the Tāpti Valley Railway), and from Anand to Ujjain. At Ahmadābād, the Rājputāna metre-gauge system begins, and running through the Native States of Rājputāna, extends to Agra and Cawnpore in the United Provinces, and to Delhi and Bhatinda in the Punjab. From Ajmer a branch runs through Central India to connect with the Great Indian Peninsula at Khandwā. There are numerous important places of pilgrimage on the system, and, though the railway passes through somewhat sparsely populated tracts, many large cities and towns are served by it. The passenger traffic, therefore, is considerable, amounting in 1904 to 34,500,000 persons, of whom 26,250,000 were of the third class. With direct access to the port of Bombay from a large part of North-Western and Central India, the goods traffic is heavy, amounting in 1904 to 3,250,000 tons. Besides the salt-works at Khārāghoda already referred to, the Sāmbhar Salt Lake is situated on the system, and the salt-works in the Jodhpur State are served by it. These three places are the only sources of supply between Bombay in the south, Calcutta

in the east, and the salt-mines in the north of the Punjab, and consequently provide all the salt consumed over a very large area, the quantity carried by the Bombay, Baroda, and Central India Railway in 1904 amounting to 400,000 tons. Besides salt, the traffic consists chiefly of grain and seeds, cotton, metals, stone, sugar (raw), timber, and wood. An extension of the Anand-Ujjain branch to connect with Muttra via Bharatpur is now under construction on the broad gauge, and sanction has been given for the linking up of Bombay and Sind by a broad-gauge line from Viramgām to Kotri on the North-Western State Railway; but these lines will not come under the management of the existing company. The contract terminated at the end of 1905, but the working of the entire system has been entrusted to the old company under new conditions. Although the company's section has always earned enough to cover its guarantee, it has in most years been worked at a loss to the state, because of the condition that the earnings of the two half-years shall be treated separately. The loss has, however, always been more than made good by the profits of the Rājputāna-Mālwā section.

Burma Railway.

Like the Assam-Bengal, the Burma Railway is an isolated line; and there is little prospect of its being connected with the railway systems of India in the near future, on account of the very difficult and sparsely populated country which intervenes. It was begun as a state railway, but was transferred in 1896 to a company under a guarantee. It is constructed on the metre gauge and is 1,340 miles long. During the past five years it has always yielded a surplus to the Government, which in 1904 amounted to 15 lakhs. The number of passengers carried in 1904 was 16,000,000, of whom 15,750,000 were of the third class. The quantity of goods amounted to 2,000,000 tons, consisting chiefly of rice and timber.

Eastern Bengal State Railway.

The Eastern Bengal Railway was promoted under the original form of guarantee, and was constructed on the broad gauge. The first portion of the line, running from Calcutta to the Ganges at Kushtia and Dāmukdia, was opened in 1862. In the same year a line was opened from Calcutta to Port Canning, which was purchased by the state in 1868. In 1874, sanction was given for the construction on the metre gauge of a line known as the Northern Bengal State Railway, which ran from the north bank of the Ganges to Silīgurī at the foot of the Himālayas, through which the route lay to the sanitarium of Darjeeling. These two portions of the line continued to be separated by the river Ganges, across which

traffic was carried in steamers, and were separately worked, the former by the company, and the latter by the state, until 1884, when the company's contract terminated, and the systems on both sides of the river were amalgamated into one undertaking and worked as a state railway. The system has been extended at different times, the latest addition being the Bengal Central Railway from Calcutta to Khulnā, whose contract expired on June 30, 1905. At that date the entire system consisted of 495 miles on the broad gauge, of which 112 miles are double; 688 miles on the metre gauge, and 89 miles on narrower gauges: a total of 1,272 miles. A more direct route is now under construction between Calcutta and the Bengal and North-Western Railway, which will run via Rānāghāt and Godāgāri on the banks of the Ganges to Katihār, the junction with the Bengal and North-Western Railway. The Ganges is not to be bridged at present, and the portion of the line south of it will be on the broad gauge, and the rest on the metre gauge, the total length being 202 miles. As its name implies, the Eastern Bengal Railway serves the whole of Eastern Bengal. It extends on the north-east to Dhubri, from which place a line is under construction to connect with the Assam-Bengal Railway at Gauhāti; on the north-west to Katihār, where it connects with the Bengal and North-Western Railway; on the north to Silīgurī, whence the Darjeeling Himālayan 2 feet gauge railway runs to Darjeeling, the summer capital of the Bengal Government; and on the south to Diamond Harbour and Port Canning. It also works the Dacca section of 137 miles, which is an isolated line, separated from the main railway by a long steamer journey. The whole of Eastern Bengal is cut up by rivers and canals, and much of the traffic carried by the railway is derived from, or is intended for, places which can be reached only by steamers. Arrangements exist with the India General Steam and River Navigation and the Rivers Steam Navigation Companies for the carriage of a portion of this traffic in conjunction with the railway, but the competition with these companies, and with river craft generally, is great. One of the great drawbacks with which the railway has to contend is the physical obstacle of the Ganges and other rivers, the expense of bridging which has been considered too great, thus involving the transhipment of all traffic. The rise and fall of the Ganges at different seasons of the year are so great, and the erosion of the banks so constant, that it has hitherto been considered that a wagon ferry would

Roads in the first part of the nineteenth century.

In the early period of British rule matters did not advance very fast; the improvement of roads was undertaken chiefly with a view to facilitate postal communication; and until the various sections which afterwards formed the Grand Trunk Road from Calcutta to Delhi were commenced, the idea of providing for wheel traction was hardly entertained. In the Bengal Presidency the duty of opening and maintaining local roads was imposed on the zamīndārs; and, under Regulations VII of 1822 and IX of 1833, a cess of 1 per cent. on all temporarily settled estates was levied, in order to form a 'road fund' to defray the necessary expenses. Any surplus accruing from this fund, after the supply of local needs, was applied to the improvement of main roads.

How backward was the state of affairs, and how lacking in proper organization, may be gathered from the following extracts from Shore's *Notes on Indian Affairs*, vol. i. Under date May, 1833, he writes: 'As to the roads, excepting those within the limits of the civil stations, 16 miles between Calcutta and Barrackpore is all that we have to boast of. In addition to this the foundations of a road between Benares and Allahābād, and of one between Jubbulpore and Mirzāpur, have been commenced, and an attempt is now making for another between Allahābād and Delhi; but unless the construction of these roads be on a better plan, and the provision for keeping them in repair on a better footing, than has been the case with the attempts hitherto made by the English in road-making, Government might just as well spare their money.' He proceeds to say that the road between Calcutta and Benares was no better than the ordinary unmade track except just after the annual repairs, which were soon washed away by the rains, and adds: 'A few years since Government were pleased to appropriate the town duties to the improvement of the roads, and immense benefits resulted from the exertions of local committees in consequence; but scarcely were they carried into effect when orders were issued to suspend all future works, and the duties were again carried to the account of Government, while no provision was made for keeping in repair what had already been done, for which purpose a very small expense would have been sufficient.'

Control by Military Boards.

The main roads were at that time under Military Boards, one for each Presidency, without sufficient powers either financial or administrative. Later, an attempt was made to give a general control over local road operations in Bengal and Northern India to the Military Board in Calcutta, but without

the necessary increase of authority. This Board, in October, 1839, received orders to join up the various roads between Calcutta and Delhi, and to bring them into good order.

The reports made by the Bengal Board to the Governor-General from 1841 to 1849 show clearly the chaotic conditions under which the provision and maintenance of the principal roads were then carried out. The actual work was effected by the Provincial authorities through their own officers; and funds were supplied, sometimes directly by the Supreme Government, sometimes by the Local Government, and on occasion partly by Government and partly by the zamīndārs and traders directly interested, sometimes even by donations from the great nobles and Rājās whose territories were traversed by the roads in question. In 1841 the Board reported that, owing to the orders of 1839 to push on work with the utmost rapidity, the cost of metalling the Allahābād-Delhi road had risen from Rs. 1,740 to Rs. 2,702 per mile. Referring to the same orders, the Board further reported that the work between Allahābād and Delhi had, in consequence, 'been carried out with undue haste to the prejudice of the work itself. Metalling can be best done in the rainy season, but a great portion of this work has been carried on in the dry season, and owing to a want of water the executive officers themselves complain of the badness of their own work.' Of the portion of the Grand Trunk Road between Burdwān and Benares, it was stated that when the work then in hand was finished 'the distance metalled will be 203¾ miles, leaving 137¼ miles which, it is believed, will not require this operation,' a remark which shows that, even at that date, the standard aimed at was not very high.

In the Board's report for 1849 it is stated that nearly 49 lakhs had been expended on the formation of the Grand Trunk Road since its commencement up to April 30, 1848, and the probable expense of completing it was estimated at a little over 33 lakhs. This sum apparently included the cost of the prolongation from Delhi to Meerut and Karnāl, necessitated by military operations in the Punjab. Referring, in the same report, to the road from Jubbulpore to Kamptee, about 150 miles in length, the Board states that 'this portion of the Great Deccan Road is neither raised nor metalled, and has a surface width generally of 20 feet, extending in some places to 30 feet, except at the hill and *nullah ghāts*, where the road is only 18 feet.' Constant references are also made to the necessity of postponing the erection of staging bungalows

and other necessaries 'with reference to the present financial difficulties.' The powers of supervision exercised by the Military Board in Calcutta were as extensive as its financial and executive authority was limited. It reports almost in the same breath about petty culverts near the Aeng Pass in the Arakan Hills, the supply of *dongās* (canoes) for ferries in the Khāsi Hills, the repairs to *chaukīs* in the Raipur jungles, the design of causeways in Mālwā, and the grading of hill paths leading to Darjeeling or from Mussoorie to Simla. Happily, about this time a properly constituted department for carrying out civil public works was formed in the newly annexed Punjab by Captain Napier (afterwards Lord Napier of Magdala); and this was so successful that in 1854–5 the Military Boards were abolished, and Public Works Departments were organized in all the Provinces, under the general control of the Supreme Government exercised through its newly constituted Public Works Secretariat[1]. After this reform progress in road-making became much more methodical, and the up-keep more satisfactory, than had previously been the case. It should, however, be mentioned that, even in the last years of the Bengal Board's *régime*, considerable progress had been made in the construction of metalled roads between the large cities of the North-Western Provinces, which was mainly due to the Lieutenant-Governor, Mr. Thomason (1843–53).

Replaced in 1854–5 by Provincial Public Works Departments.

Influence of railways on road construction.

About the same time the construction of railways began to have a considerable influence on the function and character of new roads. With the extension of the railway system, it has become more and more necessary to build roads in a direction which will enable them to feed rather than compete with the newer means of communication; and greater demand for metalled roads has also been aroused. In 1823 Mr. Malony, when advocating an improvement in that portion of the Great Deccan Road which lies between Nāgpur and Jubbulpore, represented that 'the actual amount of local produce was in excess of the consumption,' and that 'for the prosperity of the country cheap and easy communication for the exportation of the excess of produce was indispensable.' This remark states shortly the chief object with which roads were generally constructed in the first half of the nineteenth century; and as the harvest season coincided with the drying up of the rivers, there was not much need for bridges except on the great trunk roads, while even on these permanent bridges have not to this day been provided over many of the larger rivers,

[1] See Vol. IV, chap. x, Public Works Organization.

ferries or floating bridges doing duty in their place. The majority of early roads were, therefore, merely embankments across low-lying places, with easily graded approaches to river banks, and cleared and levelled surfaces elsewhere. With the introduction of railways the circumstances altered, and there arose a demand for bridged and metalled communications which would give access to the railway line at all times of the year. In some cases, no doubt, old routes have to a certain extent been superseded by railways as a means of through communication; but on the whole the influence of railways has been in the direction of stimulating progress in road construction and developing the traffic to be carried.

Influence of local self-government.

Another great factor in stimulating the construction and up-keep of roads has been the extension of local self-government. As will be seen from chapter ix of Volume IV, the number of municipalities which are responsible for the up-keep of roads within their limits was largely increased between 1860 and 1870, and their powers were considerably enhanced in pursuance of the policy of local control over local affairs initiated by Lord Mayo in 1870–1 and developed by Lord Ripon in 1881–4. As a result, too, of these latter measures, most Provinces of British India are now provided with District and Sub-District boards, whose primary duty it is to apply the funds at their disposal from the land-cess and other sources of local income to the maintenance and improvement of local communications. Accordingly, just as the substitution of Provincial Public Works Departments for the old Military Boards, and the financial decentralization effected by Lord Mayo and Lord Lytton[1], enabled the Government of India to transfer most of the responsibility for road work to the Local Governments, so the extension of local self-government carried the process of decentralization a step farther, and enabled the Provincial Governments to delegate a large portion of their functions in this respect to District boards. In each case the extension of local control was accompanied by considerable improvement in local communications. In Madras decentralization has been carried so far that nearly all the roads are in the hands of local bodies, but in most Provinces the Local Government still maintains the main lines of communication. In Madras and Bengal, the District boards employ an independent staff to deal with the roads and other local public works within their charge; elsewhere the road work sanctioned by the local boards is generally carried out by the Public Works

[1] See Vol. IV, chap. vi, Finance.

Department. The labour of the workers whom the Government has to support in times of famine is also largely devoted to roadmaking.

Present classification of roads.

With the constitution of a suitable organization to look after the business of road-building and maintenance, a methodical classification of existing and future roads became necessary, and all roads are now classed as follows:—

Class I. Metalled.
(*a*) With bridges or ferries, and drained throughout.
(*b*) Partially bridged and drained.

" II. Unmetalled.
(*a*) With bridges or ferries, and drained throughout.
(*b*) Partially bridged and drained.

" III. Banked and surfaced, but not drained.

" IV. Banked, but not surfaced: partially bridged and drained.

" V. Cleared, and partially bridged and drained.

" VI. Cleared only.

Most of the Class I (*a*) roads, and some of the others, have avenues of trees planted along them; and although it is no longer necessary to build *chaukīdāri* huts on the main routes, it is usual to provide rest-houses and *sarais* for travellers along all roads on which the amount of traffic justifies the expenditure.

Maintenance, cost, &c.

Most Indian roads are metalled with broken brick (*khoā*) or with *kankar* (nodular limestone), in the absence of stone and gravel, which are not procurable over vast areas. The expense of maintenance is somewhat high, and is greatly increased by the inferior character of the wheels of native conveyances.

The cost of building roads depends largely on the nature of the country through which they pass, and varies so greatly in different parts of India that to quote average figures would be misleading. Thus the roads are rendered expensive in Bengal by the necessary embankments, the large amount of drainage to be crossed, and the inferior nature of the metalling[1]; and in Bombay and parts of Madras by the hilly character of the

[1] 'Persons whose experience is confined to Europe may find it difficult to realize the idea of a perfectly flat country extending for several hundred miles in every direction, and where there is not so much as a pebble to be found throughout its whole extent. Such is Bengal. Stone, if used, must be brought from enormous distances, and the only possible substitute for it as a road surface is the expensive and imperfect one of broken bricks.'—Sir G. Chesney's *Indian Polity* (third edition), pp. 282–3.

country. The cost of maintenance varies from similar causes, and also, in the case of roads maintained by local bodies, with the amounts these can afford to allot.

In former times the roads were, in certain cases, built and maintained by forced labour, but this is no longer the case. It used also to be customary to levy tolls at all ferries and large bridges, and at many other intermediate spots. The number of places at which tolls for the use of roads are now levied is (except in Madras) comparatively small; and these are chiefly at ferries, where the toll is in the nature of payment for service rendered, and on hill roads whose up-keep is exceptionally expensive.

Conveyances.

Roads and railways together have revolutionized the methods of transport, causing pack animals to be almost entirely displaced by wheeled vehicles throughout the greater part of the country. In olden times hackeries hardly existed outside the large towns; and though we know, from Tavernier, that heavy wagons drawn by five or six pairs of oxen were used in the plateaux and elevated tracts of Central and Southern India, these had to be steadied with cords at the river banks and other bad places, where too they often had to be unloaded. Light springless carts drawn by a pair of oxen could carry travellers 30 or 35 miles a day under favourable circumstances. The commerce of the country was, however, as already stated, chiefly dependent on pack animals for transport, and enormous caravans of these used to traverse the Peninsula, carrying merchandise from one point to another. At the present time it is only where railways have not yet penetrated that pack transport has preserved any important share of long-distance traffic, though in sandy or hilly tracts a considerable amount of local traffic is still dependent on this means of conveyance.

Railed roads.

In several instances well-built roads have been wholly or partly utilized for the purposes of light railways and tramways, and an increase in railed roads of this description has been strongly advocated. It will always, however, be necessary to provide communications which can be utilized by the conveyances and vehicles in general use by the people, and care is therefore taken, when granting concessions for laying light tramways on existing roads, to safeguard the public interests in this matter. Whether in the future self-propelled vehicles will supersede steam tramways or give a new impetus to their provision is a problem which events alone can solve. Should it prove that such vehicles, running on an open road, can compete economically with those running on rails, the result

will prove an immense benefit to India, which now possesses a fairly large mileage of suitable roadways.

Statistics. The collection of statistics regarding roads in India has never received much attention, for their classification, the circumstances under which they are constructed, the demands which they meet, and the funds available for their up-keep vary so greatly in different parts of the country that there is no common object to be served by their compilation. The following figures will, however, give a fair idea of the road mileage of British India in 1901–2:—Total length of metalled roads about 37,000 miles, the up-keep of which is divided pretty equally between Government and local authorities; total length of unmetalled roads about 136,000 miles, of which about five-sevenths are maintained by local bodies. The above statistics relate to roads under regular maintenance. There are also a number of roads which are repaired or re-constructed at irregular intervals, e.g. during famines, and others which are maintained by the Forest Department or by the owners of large private estates. In the same year, the total gross outlay (excluding that by municipalities) on 'civil works,' of which roads constitute the most important item, was $5\frac{1}{3}$ crores, of which $1\frac{2}{3}$ crores was contributed by local boards.

BIBLIOGRAPHY

Minutes by the Governor-General of India (Lord Dalhousie), dated April 20, 1853, and February 28, 1856, respectively.

Reports of the Select Committees of the House of Commons appointed in 1878 and 1879 on the expediency of constructing Public Works in India with money raised on loan.

Reports of the Select Committees appointed in 1881 and 1882 on the rates charged on Indian Railways, the laws affecting those charges, and the desirability of appointing a Railway Commission.

Report of the Select Committee appointed in 1884 on the necessity for the more rapid extension of railways in India.

Sir John and Sir Richard Strachey.—*Finances and Public Works of India* (1882).

Sir George Chesney.—*Indian Polity*, chaps. xvii and xix (1894).

Sir John Strachey.—*India* (1903).

Horace Bell.—*Railway Policy in India* (1894).

Annual Reports on Indian Railways, by Sir Juland Danvers, up to the year 1881–2.

Annual Administration Reports on Railways in India, published by the Government of India. (Calcutta.)

Annual History of Railway Projects, published by the Government of India. (Calcutta.)

Report on the Administration and Working of Indian Railways, by Thomas Robertson (1903).

APPENDIX

STATISTICS OF RAILWAY PROGRESS

TABLE I

GENERAL RESULTS OF WORKING

YEAR.	Gross earnings (in lakhs of rupees).	Working expenses (in lakhs of rupees).	Net earnings (in lakhs of rupees).	Percentage of expenses on gross earnings.	Gain or loss to the State (in lakhs of rupees).
1861	99	58	41	59	Information not available.
1871	6,59	3,68	2,91	56	
1881	14,32	7,07	7,25	49	−39
1891	24,04	11,30	12,74	47	− 2
1901	33,60	15,72	17,88	47	+ 1,15
1904	39,65	18,78	20,87	47	+ 2,63

TABLE II

MILEAGE OPEN FOR TRAFFIC AT DIFFERENT PERIODS, WITH TOTAL OUTLAY

YEAR.	5′ 6″ gauge.	3′ 3⅜″ gauge.	2′ 6″ gauge.	2′ 0″ gauge.	Total of all gauges.	Total outlay (in crores of rupees).
	Miles.	Miles.	Miles.	Miles.	Miles.	
1861	1,587	...	...	...	1,587	34
1871	5,057	17	...	...	5,074	90
1881	6,960	2,803	78	49	9,890	141
1891	10,062	6,918	249	79	17,308	221
1901	14,047	10,506	548	362	25,363	339
1905 June 30	14,938	11,850	939	327	28,054	359

TABLE III

Railway Mileage open for Traffic at the End of June, 1905, showing Gauges and Agencies by which worked

Gauge.	State Railways worked by the agency of			Guaranteed Railways worked by the agency of		Assisted Railways worked by the agency of		Unassisted Railways worked by the agency of	Native State Railways worked by the agency of			Foreign Railways worked by the agency of	Railways of all classes worked by the agency of			Total.
	State.	Company.	Native State.	State.	Company.	State.	Company.	Companies.	State.	Company.	Native State.	Companies.	State.	Company.	Native State.	
5′ 6″	4,718	6,819	...	32	1,536	502	397	22	202	710	...	...	5,454	9,484	...	14,938
3′ 3⅜″	717	7,375	124	...	...	51	291	1,131	...	782	1,305	74	768	9,653	1,429	11,850
2′ 6″	187	286	...	...	...	...	72	154	34	189	17	...	221	701	17	939
2′ 0″	36	...	...	...	...	...	108	...	...	183	...	...	36	291	...	327
Total	5,658	14,480	124	32	1,536	553	868	1,307	236	1,864	1,322	74	6,479	20,129	1,446	28,054

TABLE IV. Number of Passengers carried and Earnings

Year.	First Class.		Second Class.		Intermediate Class.		Third Class.		Total (including Season and Vendors' Tickets).		Total mileage travelled by all passengers (in millions).
	Number (in thousands).	Earnings (in lakhs of rupees).	Number (in thousands).	Earnings (in lakhs of rupees).	Number (in thousands).	Earnings (in lakhs of rupees).	Number (in thousands).	Earnings (in lakhs of rupees).	Number (in thousands).	Earnings (in lakhs of rupees).	
1871	144	1·0	643	1·1	524	0·3	17,630	1,41	18,879	1,65	Information not available.
1881	269	1·7	1,177	2·6	2,861	0·3	50,456	3,09	54,764	3,79	2,596
1891	478	2·5	2,768	3·5	4,696	0·5	114,905	5,80	122,855	6,86	5,226
1901	532	3·3	2,405	5·2	6,670	0·6	170,416	8,48	194,749	10,07	7,797
1904	608	4·1	2,715	6·0	7,394	0·7	199,651	9,90	227,097	11,76	9,007

TABLE V

AVERAGE RATES CHARGED FOR PASSENGERS AND GOODS

Year.	Passengers per Mile.				Goods (per Ton per Mile).
	First Class.	Second Class.	Intermediate Class.	Third Class.	
	Pies.	Pies.	Pies.	Pies.	Pies.
1881 . .	13·01	4·75	4·04	2·55	7·95
1891 . .	12·32	4·92	3·11	2·33	6·75
1901 . .	12·75	5·49	3·09	2·31	5·77
1904 . .	13·41	5·69	3·09	2·34	5·39

TABLE VI. TONNAGE OF GOODS CARRIED AND EARNINGS

Year.	Grain and Seeds.		Coal.		Cotton.		Salt.		Sugar.		Total (including all other goods).		Total Freight.
	Tons (in thousands).	Rs. (in lakhs).	Tons (in thousands).	Rs. (in lakhs).	Tons (in thousands).	Rs. (in lakhs).	Tons (in thousands).	Rs. (in lakhs).	Tons (in thousands).	Rs. (in lakhs).	Tons (in thousands).	Rs. (in lakhs).	Ton-mileage (in thousands).
1881 .	Information not available.										13,214	9,56	2,309,169
1891 .	7,895	5,73	2,703	1,01	958	1,75	1,326	82	929	72	26,159	15,61	4,438,992
1901 .	10,591	7,03	8,016	2,35	1,371	2,21	1,627	93	1,483	1,13	43,392	21,24	7,061,865
1904 .	12,361	8,97	9,397	2,56	1,584	2,30	1,647	1,02	1,447	1,15	52,051	25,19	8,974,477

TABLE VII

Dates of Expiration of Contracts with Companies which own or work Principal Railways.

Companies.	Date of contract.	Date on which contract expires.	Original or renewed contract.
Assam-Bengal . .	April 26, 1892	Dec. 31, 1921	Original.
Bengal and North-Western	Dec. 12, 1882	Dec. 31, 1932	,,
Bengal-Dooars . .	April 27, 1891	Dec. 31, 1919	,,
Bengal-Nagpur . .	Mar. 9, 1887	Dec. 31, 1913	,,
Bombay, Baroda, and Central India	Nov. 21, 1855	Dec. 31, 1905	,,
Burma. . . .	Mar. 9, 1897	Dec. 31, 1921	,,
Delhi-Umballa-Kalka .	Feb. 12, 1889	Dec. 31, 1916	,,
East Indian . . .	Dec. 22, 1879	Dec. 31, 1919	Renewed.
Great Indian Peninsula	Dec. 21, 1900	June 30, 1925	,,
Indian Midland . .	Oct. 2, 1885	Dec. 31, 1910	Original.
Madras . . .	Dec. 22, 1852	Dec. 31, 1907	,,
Nizam's . . .	Dec. 27, 1883	Dec. 31, 1913	,,
Rohilkund and Kumaon	Oct. 12, 1882	Dec. 31, 1932	Renewed.
South Indian . .	Nov. 24, 1890	Dec. 31, 1910	,,
Southern Mahratta .	June 1, 1882	June 30, 1907	Original.
Southern Punjab . .	Aug. 13, 1895	Dec. 31, 1923	,,
Tapti Valley . .	Aug. 28, 1896	Dec. 31, 1921	,,

TABLE VIII

Comparative Statistics of Railway Development in the Principal Countries of Europe, the United States of America, Japan, and India

Country.	Area in square miles.	Population.	Rail mileage open.	Inhabitants per mile of line.	Square miles per mile of line.
United Kingdom (1902)	121,027	42,372,556	22,152	1,913	5
France (1902) .	207,050	38,961,950	24,249	1,607	8
Germany (1901)	208,830	56,367,180	32,878	1,714	6
Austria-Hungary (1901-2)	241,330	45,405,270	22,917	1,981	10
Italy (1903) .	110,550	32,961,000	9,960	3,309	11
Russian Empire (1902)	8,660,395	129,004,520	37,287	3,460	232
United States (1902)	3,567,560	76,303,400	203,132	376	17
Japan (1901-2)	161,113	46,634,000	4,116	11,330	39
India (1905) .	1,765,187*	294,884,567*	28,054†	10,511	63

* Based on the Census of 1901, including Portuguese and French Possessions, but excluding Aden, the Andamans, Nicobars, and Laccadives.

† Mileage open on June 30, 1905.

TABLE IX

Railways worked by each Railway Administration on June 30, 1905

No.	Name of Railway by which each system is worked.	Total mileage.	Railways comprising system.	Mileage.	Gauge.
1	Assam-Bengal . .	775	Assam-Bengal * . .	740	Metre.
			Noakhali (Bengal) † .	35	,,
2	Baraset-Basirhat .	26	Baraset-Basirhat † . .	26	2′ 6″
3	Barsi	22	Barsi †	22	,,
4	Bengal and North-Western . .	1,468	Bengal and North-Western †	902	Metre.
			Tirhoot * . . .	566	,,
5	Bengal-Dooars . .	153	Bengal-Dooars † . .	36	,,
			Bengal-Dooars Extensions †	117	,,
6	Bengal-Nagpur . .	2,039	Bengal-Nagpur * . .	1,696	Broad.
			Jubbulpore-Gondia * .	230	2′ 6″
			Mohurbhanj ‡ . . .	32	,,
			Parlakimedi ‡ . . .	25	,,
			Raipur-Dhamtari * . .	56	,,
7	Bhavnagar-Gondal-Junagad-Porbandar	485	Bhavnagar-Gondal-Junagad-Porbandar § . .	834	Metre.
			Dhrángadra § . . .	21	,,
			Jamnagar § . . .	54	,,
			Jetalsar-Rajkot § . .	46	,,
8	Bombay, Baroda, and Central India . .	3,022	Ahmedabad-Dholka † .	33	,,
			Ahmedabad-Parantij † .	55	,,
			Bombay, Baroda, and Central India † . . .	504	Broad.
			Gaekwar's Dabhoi ‡ .	95	2′ 6″
			Gaekwar's Mehsana ‡ .	93	Metre.
			Godhra-Rutlam-Nagda * .	141	Broad.
			Nagda-Ujjain ‡ . .	34	,,
			Palanpur-Deesa * . .	17	Metre.
			Petlad-Cambay ‡ . .	33	Broad.
			Rajpipla ‡ . . .	37	2′ 6″
			Rajputana-Malwa * . .	1,783	Metre.
			Tapti Valley † . .	156	Broad.
			Vijapur-Kalol-Kadi ‡ .	41	Metre.
9	Bukhtiarpur-Behar .	18	Bukhtiarpur-Behar † .	18	2′ 6″
10	Burma	1,340	Burma *	1,340	Metre.
11	Darjeeling-Himalayan	51	Darjeeling-Himalayan * .	51	2′ 0″
12	Deoghur . . .	5	Deoghur † . . .	5	Metre.
13	Dibru-Sadiya . .	86	Dibru-Sadiya † . . .	78	,,
			Ledo and Tikak-Margherita †	8	,,

* State line worked by company.
‡ Native State line worked by company.
† Line owned and worked by company.
§ Line owned and worked by Native State.

TABLE IX (*continued*)

RAILWAYS WORKED BY EACH RAILWAY ADMINISTRATION ON JUNE 30, 1905

No.	Name of Railway by which each system is worked.	Total mileage.	Railways comprising system.	Mileage.	Gauge.
14	Eastern Bengal	1,272	Cooch Behar *	34	2′ 6″
			Eastern Bengal †	495	Broad.
			Eastern Bengal †	637	Metre.
			Eastern Bengal †	55	2′ 6″
			Mymensingh-Jamalpur-Jagannathganj ‡	51	Metre.
15	East Indian	2,225	Delhi-Umballa-Kalka §	162	Broad.
			East Indian §	1,962	,,
			South Behar ‖	79	,,
			Tarkessur ‖	22	,,
16	Great Indian Peninsula	2,988	Agra-Delhi Chord §	120	,,
			Bhopal-Itarsi (British section) §	13	,,
			Bhopal-Itarsi (Native State section) ¶	44	,,
			Bhopal-Ujjain ¶	113	,,
			Bina-Goona-Baran ¶	146	,,
			Great Indian Peninsula §	1,562	,,
			Gwalior ¶	183	2′ 0″
			Indian Midland §	807	Broad.
17	Howrah-Amta	37	Howrah-Amta ‖	37	2′ 0″
18	Howrah-Sheakhala	20	Howrah-Sheakhala ‖	20	,,
19	Jodhpur-Bikaner	834	Jodhpur-Bikaner **	710	Metre.
			Jodhpur-Hyderabad ††	124	,,
20	Jorhat	30	Jorhat †	30	2′ 0″
21	Kalka-Simla	59	Kalka-Simla ‖	59	2′ 6″
22	Madras	1,493	Kolar Gold-fields ¶	10	Broad.
			Madras ‖	904	,,
			Madras (North-east line) §	497	,,
			Nilgiri	17	Metre.
			Shoranur-Cochin ¶	65	,,
23	Morvi	90	Morvi **	73	Metre.
			Morvi **	17	2′ 6″
24	Nizam's Guaranteed State	742	Bezwada Extension §	21	Broad.
			Hyderabad-Godavari Valley ¶	391	Metre.
			Nizam's Guaranteed State ¶	330	Broad.
25	North-Western	4,028	Dandot †	6	2′ 0″
			Jammu and Kashmir *	16	Broad.
			Khushalgarh-Kohat-Thal †	92	2′ 6″
			Ludhiana-Dhuri-Jakhal *	79	Broad.
			North-Western †	3,186	,,
			Nowshera-Durgai †	40	2′ 6″
			Rajpura-Bhatinda *	107	Broad.
			Southern Punjab ‡	502	,,

* Native State line worked by state agency. † State line worked by the state. ‡ Company's line worked by state agency. § State line worked by company. ‖ Line owned and worked by company. ¶ Native State line worked by company. Line owned and worked by Native State. †† State line worked by Native State.

TABLE IX (*continued*)

RAILWAYS WORKED BY EACH RAILWAY ADMINISTRATION ON JUNE 30, 1905

No.	Name of Railway by which each system is worked.	Total mileage.	Railways comprising system.	Mileage.	Gauge.
26	Oudh and Rohilkhand	1,277	Cawnpore-Burhwal * .	80	Metre.
			Hardwar-Dehra † . .	32	Broad.
			Oudh and Rohilkhand * .	1,165	,,
27	Rohilkund and Kumaon . . .	331	Lucknow-Bareilly ‡ . .	237	Metre.
			Powayan §	40	2′ 6″
			Rohilkund and Kumaon §	54	Metre.
28	South Indian . .	1,353	Karaikkal-Peralam ‖ .	15	,,
			Pondicherry ‖	8	,,
			South Indian ‡ . . .	1,123	,,
			Tanjore District Board ¶ .	99	,,
			Tinnevelly-Quilon (British section) ‡	50	,,
			Tinnevelly-Quilon (Native State section) **	58	,,
29	Southern Mahratta .	1,687	Birur-Shimoga ** . .	38	Metre.
			Guntakal-Mysore Frontier ‡	120	,,
			Hindupur (Yesvantpur-Mysore Frontier) ** .	51	,,
			Hospet-Kottur ‡ . .	44	,,
			Kolhapur ** . . .	29	,,
			Mysore-Nanjangud ** .	16	,,
			Mysore section (Southern Mahratta) ‡ . . .	296	,,
			Southern Mahratta ‡ .	1,042	,,
			West of India Portuguese‖	51	,,
30	Tarakeshwar-Magra .	83	Tarakeshwar-Magra § .	33	2′ 6″
31	Tezpore-Balipara .	20	Tezpore-Balipara § . .	20	,,
32	Thaton-Duyinzaik .	8	Thaton-Duyinzaik §. .	8	,,
33	Udaipur-Chitor . .	67	Udaipur-Chitor †† . .	67	Metre.

* State line worked by the state. † Company's line worked by state agency. ‡ State line worked by company. § Line owned and worked by company. ‖ Foreign Government line worked by company. ¶ Local Board line worked by company. ** Native State line worked by company. †† Line owned and worked by Native State.

CHAPTER VIII

POSTS AND TELEGRAPHS

I. Post Office

Postal service prior to 1854.

PRIOR to the year 1837 India possessed no general postal system. A few lines of mail couriers, connecting the principal towns with the seats of Government, had been established for the conveyance of official letters and parcels; but their use by private individuals was conceded only as a privilege on payment[1]. In 1837, under the provisions of Act XVII of that year, a public post was established, and the Government reserved to itself the exclusive right to convey letters for payment in the territories of the East India Company. The postmasters of the Presidency towns supervised the working of a certain number of Provincial post offices, and provided for the conveyance of mails over a few main lines of communication, while Collectors had charge of District post offices and local mail lines. The charges for the conveyance of letters were levied in cash, payable in advance, and varied according to weight and distance. Thus, the charge for sending a letter from Calcutta to Bombay was one rupee, and from Calcutta to Agra 12 annas, per tola[2].

Establishment of the Postal department on its present footing.

In 1850 a Commission was appointed to report on the working of the Post Office, and the result was the repeal of Act XVII of 1837 and the enactment of Act XVII of 1854 (the Indian Postal Act). This Act marks the commencement of the organization of the Indian Post Office on its present footing. Under its provisions the whole department was placed under the control of a Director-General; the office of Postmaster-General was separated from that of Presidency

[1] The conveyance of letters by such couriers (*kāsid*, *patamar*, or *harkāra*) was extensively developed under native rule from early times. And it is interesting to notice that the vernacular words (*dāk* in Northern India, and *tappāl* in the south and west) are derived, like the English word, from the stages at which relays of couriers, or other methods of conveyance, were stationed.

[2] A tola is three-eighths of an ounce, being the precise weight of a rupee.

Postmaster; Postmasters-General were appointed for the direct administration and supervision of the postal services of the larger Provinces; and Deputy Postmasters-General, at first designated Chief Inspectors, for the less important Provinces and the principal Political Agencies. Postage stamps were now first introduced, and rates were fixed for the conveyance of letters irrespective of distance. The Act of 1854 remained in force till 1866, when it was repealed by Act XIV of that year, which was, in its turn, superseded by Act VI of 1898. This last Act forms the present legal sanction for the working of the Post Office. It supplied certain defects and omissions in the previous Act, conferred extended protection and powers, and provided increased facilities for postal insurance, the value-payable post, and the money-order system.

Classes of postal articles carried and rates of inland postage. Letters.

The main business of the Post Office is the conveyance and delivery of letters, postcards, newspapers, book and pattern packets, and parcels. From 1854 to 1869 the lowest rate of inland letter postage was ½ anna for ¼ tola. The next charge was 1 anna for ½ tola; and for weights above ½ tola the scale progressed by 2 annas per tola, and thereafter by 1 anna per ½ tola. In 1869 the weight allowed for each rate of postage was doubled; the initial charge thus became ½ anna for ½ tola. This rate continued in force until April, 1905, when the weight allowed for ½ anna (now equivalent to a halfpenny) was raised to ¾ tola. The charge for heavier letters is 1 anna for 1½ tolas.

Newspapers.

The minimum postage on newspapers was originally 1 anna for 6 tolas of weight; but the rates have from time to time been reduced. In October, 1898, ¼ anna was made the inland rate for a registered newspaper not exceeding 4 tolas in weight, and ½ anna the rate for a registered newspaper exceeding 4 but not exceeding 20 tolas, while an additional ½ anna was charged on every additional 20 tolas or part of that weight. The weight allowed for ¼ anna was raised to 6 tolas in January, 1904. The postage on packets other than newspapers was 1 anna for 10 tolas until 1878, when it was lowered to ½ anna.

Parcels.

The Post Office at first carried parcels at rates varying with weight and distance. In 1870 a uniform rate of 3 annas for 10 tolas was adopted. In 1873 the minimum charge was fixed at 4 annas for 20 tolas, but four years later it was altered to 8 annas for 40 tolas. The present rates of inland parcel postage, which came into force in July, 1901, are—(1) in the case of parcels not exceeding 440 tolas in weight, 2 annas for

the first 20 tolas, 4 annas for any weight exceeding 20 but not exceeding 40 tolas, and 2 annas for every additional 40 tolas; and (2) in the case of parcels exceeding 440 tolas in weight, 3 rupees for a parcel not exceeding 480 tolas in weight, and 4 annas for every additional 40 tolas.

Registration and insurance.

The registration of postal articles was one of the additional facilities afforded to the public by the Postal Act of 1854, superseding the previous practice of giving receipts for all letters at the time of posting. The registration fee is now 2 annas for all classes of articles.

The insurance of postal articles was introduced in 1878, mainly in order to separate valuable articles from the rest of the mail. There was at first no restriction on the amount for which an article might be insured; but in 1890 a limit of Rs. 1,000 was fixed, which was raised in 1898 to Rs. 2,000. The insurance fee was reduced in 1905 from $\frac{1}{4}$ to $\frac{1}{8}$ per cent. on the value, subject to a minimum of 1 anna. The gross amount for which articles were insured by the Post Office in 1903-4 was more than 10 crores of rupees, and the insurance fees yielded about $2\frac{3}{4}$ lakhs.

Value-payable system.

The value-payable, or cash on delivery, system was introduced into India in December, 1877, and was extended in 1891 to the postal exchange between India and Ceylon. Under this system, the Post Office undertakes to collect from the addressee the price specified for payment on certain classes of articles sent for sale, and to transmit the money to the sender. The following table shows the steady increase in the value-payable business of the Post Office since the introduction of the system:—

YEAR.	Number of articles carried.	Value specified for recovery (in lakhs of rupees).	Commission realized (in lakhs of rupees).
1880-1	49,389	6	0·1
1890-1	1,108,888	1,16	2·1
1900-1	2,608,888	3,42	5·9
1903-4	3,886,297	4,50	6·4

In 1903-4 Calcutta tradesmen realized about 136 lakhs by this method, and the tradesmen of Bombay nearly 78 lakhs.

Entry of India into Postal Union, and postage

In 1875 the Universal Postal Union was established; and in the following year India became a member, and a party to the Convention which regulates the carriage of letters, postcards, and packets between all countries of the Union. In

1892 India applied the standard Union rates to correspondence for all parts of the world, whether within or outside the Postal Union; and in 1898 she joined in the scheme for the adoption of a uniform rate of postage at the rate of a penny per half ounce on letters throughout the British Empire. Rates to foreign countries.

In 1873 arrangements were made for the carriage of parcels to and from England, and for their collection and distribution, by the Peninsular and Oriental Steam Navigation Company. This was soon followed by the introduction of exchanges of postal parcels with certain other European countries, and with several British colonies. In 1885 the exchange of parcels with the United Kingdom was transferred to the agency of the British Post Office, and in 1899 India joined the International Parcel Post Union. Parcels can now be exchanged by post between India and almost every country in the world. Foreign Parcel Post.

Prior to 1880 sums not exceeding Rs. 150 could be remitted by money order from one District treasury to another. A commission of about 1 per cent. was charged, and the remitter had to send the order obtained by him from the remitting treasury to the payee, who was required to present it for encashment at the treasury of payment. The cost of transmitting the order was a charge over and above the commission, and there was, besides, the risk of the order being lost or stolen in the post unless forwarded under the security of registration. In 1878–9 the District treasuries issued monthly (on an average) 20,605 money orders of the aggregate value of 7·4 lakhs, yielding a commission of Rs. 8,823. From January 1, 1880, this money-order business was taken over by the Post Office. The commission remained the same, but a radical change was made in the procedure. The remitter had only to fill in an application, the Post Office undertaking to transmit the money to the payee, and to obtain his acknowledgement and deliver it to the remitter. The immediate effect of this change of agency, by which 5,090 post offices of issue and payment were substituted for 321 treasuries, was that the business done quadrupled within three months, the number of money orders issued in the single month of March, 1880, being 97,284, of the aggregate value of more than 31 lakhs, and yielding a commission of Rs. 36,238. Inland money orders.

Numerous and important improvements have been made in the system since its transfer to the Post Office. Among them may be mentioned the addition to the form of application of a 'coupon,' on which the remitter is at liberty to write a com-

munication to the payee, which is carried and delivered free to the latter; the payment of money orders by postmen at the residences of the payees, introduced in 1884; the introduction, also in 1884, of the telegraphic money-order system; and the use of finger impressions for the identification of illiterate payees. The rates of commission on ordinary money orders now stand as follows:—On sums up to Rs. 15, 1 anna on each Rs. 5 or fraction thereof; and on sums between Rs. 15 and Rs. 25, 4 annas. Sums exceeding Rs. 25 are similarly charged—thus a money order for Rs. 40 (25+15) would pay 7 annas. For telegraphic money orders the scale of charges begins with 2 annas for any sum not exceeding Rs. 10, and progresses in the same way as ordinary money-order rates up to Rs. 150. For any sum exceeding Rs. 150 up to Rs. 600, which is the limit for both ordinary and telegraphic money orders, the charge is R. 1-8 for a complete sum of Rs. 150, *plus* 2 annas for each additional sum of Rs. 10. In addition to the ordinary fee, a rupee is charged for the cost of the telegram in the case of Urgent orders, and 8 annas in the case of Deferred orders, and credited to the Telegraph department.

On the money-order system proper have been grafted measures, adapted to the individual requirements of each case, for the remittance of rent to landowners and of Government dues such as land revenue, cesses, and income-tax. These systems have a special value in protecting the people from illegal exactions. The landowner is saved from improper demands made by subordinate revenue officials, and the tenant is protected against the landlord or his agents.

Statistics of inland money-order business.

The following table shows the inland money-order transactions of the Indian Post Office for the years 1880-1, 1890-1, 1900-1, and 1903-4:—

YEAR.	Total number of money orders issued.	Total value (in lakhs of rupees).	Commission realized by the Post Office (in lakhs of rupees).
1880-1	1,604,174	4,57	5
1890-1	7,326,065	15,78	19
1900-1	12,922,465	26,27	33
1903-4	16,470,115	29,44	34

In 1903-4 the average amount of an inland money order was Rs. 17-13-11.

Foreign money orders drawn upon, or received from, the United Kingdom, and also most British colonies and foreign countries, are expressed in sterling; but there are a few foreign countries and British possessions to and from which money orders are advised in Indian currency. Foreign money orders and British postal orders.

The following table shows the number and amount of foreign money-order transactions for the years 1880-1, 1890-1, 1900-1, and 1903-4:—

Year.	Foreign money orders issued in India.		Foreign money orders paid in India.	
	Number.	Amount in Indian currency (in lakhs).	Number.	Amount in Indian currency (in lakhs).
1880-1 . . .	19,281	11	4,028	2
1890-1 . . .	54,407	27	54,036	40
1900-1 . . .	97,202	46	252,573	1,29
1903-4 . . .	133,119	61	285,995	1,66

The sale of British postal orders for small sums was introduced in 1884. These orders are payable in the United Kingdom and at certain British post offices in foreign countries. The number sold in 1890-1 was 39,683, of the total value of £27,761. By 1903-4 the number had risen to 141,429 and the value to £90,730.

The Post Office provides, for the use of the public, postage stamps of various denominations (fourteen in 1904), embossed envelopes, postcards, and newspaper wrappers. Such of the stamps, &c., as are required for official purposes are overprinted 'On H. M. S.' (On His Majesty's Service). There is also a special ¼ anna service postcard which is prepare in India. With this exception, all stamps, embossed envelopes, postcards, and wrappers are obtained from England under contract. Postage stamps, &c.

The colour and design of the postage stamps have undergone various changes from time to time, the most important being that made in 1900-1, when India adopted the colours —green, red, and blue—recommended by the Universal Postal Union for the stamps representing the three standard Union rates of 5 centimes, 10 centimes, and 25 centimes,

of which the Indian equivalents are ½ anna, 1 anna, and 2½ annas.

Embossed envelopes and post-cards.

One of the gravest difficulties with which the Indian Post Office has had to contend is the habit of using, for postal missives in the vernacular, the flimsiest of paper folded into the minutest compass. The address often contains much superfluous matter, and is spread over the entire available space on both sides of the cover; and the difficulties thus caused are further aggravated by the post-marks which, for want of space, have to be impressed on the address. A partial remedy has been found by the Post Office in the provision of envelopes bearing ½ anna and 1 anna embossed postage stamps, which are sold at the face value of the stamps they bear. This measure was introduced in 1873 and at once became extremely popular. The practical effect was to reduce the postage by the cost of the envelopes, but the object in view and the results attained fully justified this liberality. Stamped newspaper wrappers are also provided.

The introduction, in July, 1879, of the ¼ anna inland postcard gave a lower rate of postage than had before been available, and these cards, like the embossed envelopes, are sold for their face value. In April, 1880, service postcards, for the use of Government officials, were also provided. Reply postcards were introduced in 1884. It is a noteworthy fact that the introduction of the postcard, which is now much the most popular medium of private correspondence in India, aroused considerable opposition in the public press, mainly on the ground that it would interfere with the secrecy of postal communication.

Postal arrangements in Native States.

The operations of the Imperial Post Office extend to all the Native States of India which never had postal systems of their own, and to a large number of States, including Kashmīr, Baroda, and Mysore, which have given up their separate systems. At the end of the year 1903–4 only twenty-two Native States still maintained independent postal arrangements; and with five of these (Patiāla, Nābha, Jīnd, Chamba, and Gwalior), special conventions have been made under which these States use the stamps of the Indian Post Office over-printed with their own arms or name, and each party to the conventions recognizes the stamps of the other parties for all purposes of the inland post. The postal arrangements in the remaining seventeen States, which have systems of their own, were in most cases made primarily for the purposes of State official correspondence and have been more or less extended so as to

afford facilities to the public[1]. The public facilities vary very much within these States: but except by the payment of an extra postal charge, they afford practically no postal communication to or from any outside part of India or with any other country. This and other inconveniences have led to the establishment of a certain number of Imperial Post Offices in most of the Native States in question, and these generally carry on all classes of postal work in the same way as offices in British territory.

Present organization of the department.

The following table shows the Post Office establishment as it stood on March 31, 1904:—

Chief Officers of the Offices of Direction and Account, and Heads of Circles	25
Superintendents, Assistant Superintendents, and Inspectors of Post Offices	536
Departmental Postmasters, including Deputies and Assistants	6,229
Extraneous Agents, such as Schoolmasters and Stationmasters, holding the appointment of Postmaster	9,371
Clerks	10,222
Postmen and other Servants	19,831
Road Establishment	20,419
Village Postmen	8,242
Signallers and other Servants employed for telegraph work in combined Offices	2,715
TOTAL	77,590

The chief control of the Post Office is vested in a Director-General, aided by a Deputy and three Assistants, who is now (1905) subordinate to the Government of India in the new Department of Commerce and Industry. For postal purposes India is divided into eleven Circles, which do not in all cases correspond with Provincial jurisdictions. The six most important Circles—namely, Bengal, Bombay, Madras, the United Provinces, the Punjab and North-West Frontier Province, and Burma—are administered by Postmasters-General; while the remaining five—namely, Assam, Eastern Bengal, the Central Provinces, Rājputāna, and Sind with Baluchistān—are under the control of Deputy Postmasters-General who, in postal

[1] The seventeen States in question are Hyderābād; Travancore; Cochin; Indore, Bhopāl, Orchhā, Charkhāri, Datiā, and *Chhatarpur*, in Central India; Jaipur, *Udaipur*, Būndi, Kishangarh, and *Shāhpura*, in Rājputāna; Bhor and Junāgarh in the Bombay Presidency; and Las Bela (Baluchistān). Those shown in italics do not use postage stamps; the others have stamps of their own.

matters affecting their own Circles, exercise the same functions and powers as Postmasters-General. Each postal Circle is subdivided into postal divisions comprising, generally, two or more revenue Districts. The officer in charge of a division, who is immediately subordinate to the Postmaster-General or Deputy Postmaster-General, is called a Superintendent of Post Offices, and is assisted by one or more inspectors in the duty of inspecting the post offices and mail lines in the division, and in exercising supervision over postal work generally. The branch of the Post Office which deals with the sorting and disposal of mails during transit by rail is called the Railway Mail Service, and comprises several divisions under the charge of Superintendents. With certain exceptions, this service is under an officer designated the Inspector-General, Railway Mail Service, whose head-quarters are at Allahābād.

A central office of account was established at Calcutta in 1861, under the charge of an officer who is now styled the Comptroller, Post Office. Until 1899 the whole of the work connected with the audit and control of postal accounts was concentrated in Calcutta. It became evident, however, that, owing to the large and rapid development of the money order and savings bank business of the Post Office, the audit work required to be decentralized; and in January, 1900, three Circle audit offices were established—at Calcutta, Nāgpur, and Delhi—and were placed in charge of Deputy Comptrollers, subordinate to the Comptroller at Calcutta. The audit of money orders is now entirely carried out by these Circle offices.

The everyday work of the Post Office is performed almost entirely by native agency, only a few of the higher administrative and controlling appointments being ordinarily held by Europeans. The general efficiency and honesty of the native staff are shown by the fact that in 1903-4, although 632,000,000 postal articles, and more than 17,000,000 money orders, were dealt with, only about 11,000 well-founded complaints were received from the public, that is to say, only one complaint for 64,000 articles. The total number of offences by postal servants against the law in the same period was only 437.

District Post.

Postal communication in parts of the interior of British India, to which the operations of the Imperial Post had not yet been fully extended, was until recently provided by the District Post, the original object of which was, generally, to provide communication between the head-quarters of Districts and revenue and police stations in the interior. As District

Post lines and establishments from time to time became remunerative, they were transferred to the Imperial establishment, and the funds thus set free were utilized in the further improvement of the rural delivery. Thus the District Post, when not restricted to official requirements, has acted as a pioneer of the Imperial Post. The administration of the District Post, which was originally vested in District officers, is now everywhere entrusted to the local postal authorities. Up to 1906, funds were derived in some cases from local cesses, and in others from special grants; but the entire postal service is now maintained at the cost of Imperial revenues.

Growth of postal transactions.

The figures in the first table which follows show the growth of the transactions of the Indian Post Office between 1860–1 and 1903–4. The second table shows the distribution of the figures for 1903–4 among the several postal Circles, and the number of postal articles (excluding money orders) per head of the total and the literate population. The average number of letters and postcards carried in 1903–4 was 2·2 per head of the total population of India, and 39·7 per head of the literate portion of that population, as compared with an average of 75·7 per head of population for the United Kingdom.

POSTAL TRANSACTIONS IN INDIA AS A WHOLE

YEAR.	Number of post offices open.	Number of letter-boxes open.	NUMBER OF ARTICLES (EXCLUDING MONEY ORDERS) CARRIED.					
			Letters.	Postcards.	Packets.	News-papers.	Parcels.	Total.
1860–1	889	192	42,981,708	..	292,560	4,652,268	563,676	48,490,212
1870–1	2,736	1,608	77,303,074	..	1,127,189	6,565,323	694,237	85,689,823
1880–1*	5,264	8,449	128,672,984	14,865,121	2,105,579	11,942,034	1,080,868	158,666,856
1890–1	9,419	14,271	179,678,236	101,062,176	10,375,319	24,935,368	1,901,547	317,952,646
1900–1	12,970	25,507	250,858,165	218,351,317	28,302,751	32,091,400	2,679,109	532,282,742
1903–4	15,403	34,005	286,822,556	272,523,104	34,351,819	34,262,838	3,941,809	631,902,126

* From this year figures for the District Post are included.

POSTAL TRANSACTIONS IN THE VARIOUS CIRCLES, 1903-4

POSTAL CIRCLE.	Number of post offices open.	Number of letter-boxes open.	NUMBER OF ARTICLES (EXCLUDING MONEY ORDERS) CARRIED.						NUMBER OF POSTAL ARTICLES PER HEAD OF—	
			Letters.	Postcards.	Packets.	News-papers.	Parcels.	TOTAL.	Total population.	Literate population.
Bengal	1,977	5,764	46,219,637	43,970,325	6,431,561	7,911,297	1,025,664	105,558,484	2·4	36·7
Eastern Bengal	529	1,300	7,442,429	9,942,392	950,564	1,274,502	93,310	19,703,197	1·7	16·3
Bihār	654	980	11,833,248	10,393,923	1,020,723	1,062,490	63,348	24,373,732	1·0	29·5
Bombay	1,962	7,376	49,148,162	55,841,141	5,411,255	5,224,506	686,317	116,311,381	4·8	68·1
Madras	3,151	5,933	56,328,365	47,103,667	6,804,982	5,220,152	598,226	116,055,392	2·5	36·4
United Provinces	1,858	4,545	35,669,572	33,437,989	3,943,824	3,986,869	434,104	77,472,358	1·4	48·7
Punjab and Frontier Province	2,943	4,754	32,918,699	43,404,522	4,071,444	3,822,384	575,513	84,792,562	2·8	81·8
Assam	344	452	5,228,443	3,553,353	971,604	977,287	53,725	10,784,412	1·8	48·5
Burma	339	1,404	15,629,509	1,783,077	2,379,253	1,786,023	188,726	21,766,588	2·1	9·8
Central Provinces	926	785	11,024,252	10,040,837	1,180,802	1,464,224	73,291	23,783,406	1·5	49·0
Rājputāna	461	325	8,110,639	8,026,845	508,654	695,351	80,505	17,422,084	1·4	38·2
Sind and Baluchistān	259	279	7,269,601	5,025,033	677,153	837,753	68,990	13,878,530	3·3	125·2
TOTAL	15,403	33,897*	286,822,556	272,523,104	34,351,819	34,262,838	3,941,719	631,902,126	2·2	39·7

* Not including 108 post offices in the Railway Mail Service.

The development of postal communications between the years 1860–1 and 1903–4 is shown in the following table:— Development of postal communications.

Year.	Length of Postal Lines.				
	Railway.	Steamer service (sea and river).	Mail carts, horses, camels, &c.	Runners and boats.	Total.
	Miles.	Miles.	Miles.	Miles.	Miles.
1860–1	1,046	..	5,740	36,784	43,570
1870–1	4,993	6,184	4,175	36,911	52,263
1880–1 *	9,455	14,308	2,635	63,995	90,593
1890–1	16,522	13,680	4,400	74,630	109,232
1900–1	22,839	15,822	7,937	85,023	131,621
1903–4	26,721	17,457	8,712	92,137	145,027

* From this year the figures include those of the District Post.

Post offices are organized into head, sub, and branch offices. Organization of post offices. Generally there is a head post office at the head-quarters of each revenue District, to which other post offices in the District are subordinate for purposes of accounts. The more important of the subordinate offices are designated 'sub-offices' and are usually established only in towns, while for villages there is a smaller class of 'branch offices.' Of the 15,403 post offices open on March 31, 1904, three-fourths were 'branch' offices. More than 9,000 of these were in charge of extraneous agents, such as schoolmasters, station-masters, shopkeepers, land-holders and cultivators, who perform postal duties in return for a small remuneration.

Mail runners are supplied by the Post Office with belts and Mail runners. badges, and also with spears to which clusters of small bells are attached. Ordinarily, the mail bags are tied together and suspended to one end of the spear, which is then thrown over the shoulder. The bells affixed to the spear-head are useful in scaring away wild animals, and by their jingle they help the runners to travel at a measured pace and they notify the approach of the mails. In many parts of the country mail runners are exposed to considerable danger from different causes, such as floods, storms, wild beasts, and highway robbers. Thus in 1898–9 two runners were swept away by avalanches and killed, one while carrying the mails over the Zoji La Pass on the road to Leh, and the other while crossing the Lowāri Pass on the Chitrāl line; and two runners in Bengal were killed by tigers. Since 1894, when the Kashmīr posts were taken over by the Imperial Post Office, thirty-one runners have been lost in

avalanches on the mountains in that State. Although the mails frequently contain cash and other valuables, it seldom happens that a runner attempts to tamper with them; and there are many cases on record in which runners have defended the mails in their charge at the risk, or cost, of their own lives.

Delivery of correspondence.

The extraordinary number of different languages, written in upwards of thirty distinct characters, that are in everyday use in India would in itself make the correct disposal of correspondence addressed in the vernaculars a work of extreme difficulty to the Post Office. But further obstacles to the successful performance of this work result from the habits of the people themselves—from the careless and vague way in which they often write the addresses, and the apathy with which they view the delay or loss of correspondence. The Postal department, however, endeavours as far as possible to overcome these difficulties. The total number of letters, postcards, and other articles, excluding money orders, that reached the several Dead Letter offices during the five years ending with 1903–4 was 23,000,552. Of this number, 5,160,289 (22·4 per cent.) were redirected and issued for delivery to the persons to whom they had been addressed, while 12,057,128 (52·4 per cent.) were issued for return to the senders, though out of these about 10 per cent. in all came back again to the Dead Letter offices. The total number finally found to be unreturnable was 7,572,321. This last figure is only 0·3 per cent. of the total number of articles given out for delivery during the five years in question, and a large proportion of the unreturnable articles were from their nature not capable of delivery.

Continuous delivery.

In 1897 a 'continuous delivery' system was introduced in Calcutta. The main feature of this system is that each postman has a central station on his beat to which articles for delivery are brought at short intervals by messengers from the post office. The postman can therefore work continuously at his delivery without going to and from the office. Calcutta has sixteen daily deliveries under this system, and it has led to a very large increase of local correspondence. The scheme has since been extended to Bombay and Simla.

Development of postal traffic with foreign countries.

The table on the next page shows the development, since 1870–1, of the exchanges of postal articles (correspondence and parcels) between India and the United Kingdom, and between India and all other parts of the world. The figures are given to the nearest thousand.

The earliest mail communication between Europe and India was by sailing vessels, starting at irregular intervals from

England and proceeding round the Cape of Good Hope. In 1815 the charge for a 'single' letter was 3*s*. 6*d*., payable on delivery in India, of which 1*s*. 2*d*. was paid to the ship, with an additional 2*d*. to the commander. But soldiers and sailors

Mail service between England and India.

Year.	Number of articles exchanged with the United Kingdom.		Number of articles exchanged with countries other than the United Kingdom.	
	Dispatched.	Received.	Dispatched.	Received.
1870-1 . . .	1,169,000	1,438,000	Figures not	available.
1880-1 . . .	2,976,000	6,501,000	828,000	981,000
1890-1 . . .	4,683,000	9,307,000	2,030,000	2,810,000
1900-1 . . .	4,929,000	12,163,000	3,795,000	3,543,000
1903-4 . . .	6,756,000	14,121,000	3,828,000	3,566,000

in the service of the Company or the Crown were privileged to send and receive letters at the rate of 1*d*. In 1825 the voyage was for the first time performed by steam. The steamer was of 120 horse-power and 470 tons displacement, and the voyage took 113 days. It was not until 1835 that the Indian mails were conveyed over the Isthmus of Suez and through the Red Sea. They were at first carried by monthly packets dispatched by the British Admiralty; but in 1840 the Peninsular and Oriental Steam Navigation Company was selected to convey them to Alexandria, and in 1842 that company established a line of steamers between Suez, Ceylon, Madras, and Calcutta. In view of the efforts made by the company to establish a regular mail service in the Indian Seas, it received in 1844 a contract for five years, with a subsidy of £160,000 a year, for the combined India and China services. This contract was subsequently extended, and in 1853 a new contract was concluded with the company under which fortnightly communication was secured between the United Kingdom and India (Calcutta). In 1867 a fresh contract provided for a weekly mail service to and from India (Bombay) with a transit of about twenty-six days, and an annual minimum subsidy of £400,000, to be raised, if necessary, up to £500,000 in order to make the net profit of the company equal to 6 per cent. on its capital. A new contract, in 1880, provided for a weekly service and for the transit of the mails between London and Bombay in seventeen and a half days. The next contract, which came into force in 1888, substituted for the conveyance of the mails across Egypt the passage through the

Suez Canal, the time for the transit of the mails between London and Bombay being reduced by one day. Under the latest contract with the company for a combined Eastern and Australian mail service, which came into operation in February, 1898, and expired on January 31, 1905, the time in transit between London and Bombay was reduced to fourteen and a half days. The subsidy under this contract was £330,000. The contract has recently been extended for three years, with some increase of subsidy and a reduction of one day in the transit time.

From 1854 to 1869 the trans-European route for the mail service between the United Kingdom and India was via Marseilles, but towards the end of the latter year the service by that route was supplemented by a service via Brindisi. This latter continues up to the present time to be the sole route for the Anglo-Indian mails. In 1868 a system of sorting the mails on board the mail steamers in the Indian Ocean was introduced. The mails are now landed at Bombay ready sorted for the chief towns and principal lines of railway, and are dispatched inland to destination by the first mail trains leaving after their arrival, while special trains are used for the more important routes.

Field Post Offices.

The Field Post Office, which had its origin in the Afghān War of 1878–80, proved so useful that it is now a recognized factor in every campaign in which Indian troops are employed.

Financial working of the Post Office.

The figures in the following table show, for the year 1860–1 and each succeeding tenth year, and for 1903–4, the financial results of the operations of the Indian Post Office. The figures are throughout in lakhs of rupees.

Year.	Receipts.				Expenditure.	Surplus or Deficit (+ or —).
	From the Public.		From Government departments for official postage, &c.	Total.		
	On account of postage.	On other accounts.				
1860–1	27	15	24	66	57	+ 9
1870–1	39	11	42	92	88	+ 4
1880–1	74	15	13	1,02	1,11	− 9
1890–1	1,17	3	20	1,40	1,39	+ 1
1900–1	1,71	4	29	2,04	1,84	+ 20
1903–4	1,92	3	31	2,26	2,11	+ 16

These figures include the cost of managing the Post Office savings banks, from which the Post Office derives no revenue, and the cost of a number of lines and offices maintained only for political purposes. Also no allowance is made on account of official correspondence being carried, since 1873, at unremunerative rates.

The variations in the receipts on account of official postage call for some remark. It will be noticed that, whereas these receipts were in 1860-1 almost as high as, and in 1870-1 exceeded, the revenue derived from ordinary postage, in 1903-4 they amounted to less than one-sixth of that revenue. Up to the year 1865-6 all official articles were conveyed free, and the Government departments concerned were *pro forma* debited with the postage due. The result of the almost unrestricted license to frank letters on the public service, thus given to a very large number of officials, greatly increased the number and bulk of official dispatches, and accordingly, in 1867, the system was changed. Service postage stamps were introduced and prepayment of official correspondence was insisted on. This measure was at first restricted to official articles passing out of the Presidency towns or outside the limits of the District in which they were posted; but it was gradually extended until, in 1873, all franking privileges were abolished. The result has been to reduce largely, and to keep within reasonable limits, the amount of official correspondence conveyed by the Post Office. Official correspondence.

The rates of postage applicable to official correspondence at the time service stamps were introduced were the same as for ordinary correspondence. As, however, official covers, though heavier than ordinary correspondence, were not so troublesome or expensive to deal with, it was decided in 1873 to reduce the rates. Further reductions were made in succeeding years, so that now, whereas 1 anna will convey a private letter not exceeding $1\frac{1}{2}$ tolas in weight, the same amount will suffice for an official cover of 10 tolas. On packets and parcels, official and private rates are the same. Unpaid and insufficiently paid official articles are charged on delivery at the usual postage rates, whereas on private articles a double charge is levied in similar circumstances.

In 1883 it was decided to use the agency of the Post Office in order to extend the operations of the Telegraph department without the cost of separate telegraph offices. The main features of the scheme were: (1) to authorize a large number of post offices off the telegraph line to receive inland telegrams from the public, and to send them free by post to the nearest telegraph office; and (2) to convert a large number of post offices into combined post and telegraph offices, with the telegraph branches worked by the postmasters or post-office clerks. This scheme developed rapidly; and by March 31, 1904, out of a total of 2,127 Government telegraph offices, Postal telegraph offices.

1,859 were combined with post offices, while 4,833 other post offices were authorized to receive telegrams from the public, and to send them free by post to the nearest telegraph office to be signalled.

Post Office savings banks.

The first Government savings banks established in India were those opened at the Presidency towns between 1833 and 1835, and their management was subsequently transferred, in 1863-4, to the Presidency Banks. In 1870 District savings banks were instituted in connexion with certain selected District treasuries. Post Office savings banks came into existence in April, 1882, being opened in post offices in every part of India except the Bombay Presidency. This exception, and certain restrictions in other Provinces, had reference to the special arrangements made with the three Presidency Banks for the management of the old Government savings banks. The restrictions were, however, soon removed, and by April, 1883, Post Office savings banks were in operation throughout India. The Post Office savings banks and the District savings banks continued side by side till 1886, when the latter were abolished; but the Government savings banks in the cities of Calcutta, Bombay, and Madras remained in the hands of the Presidency Banks until 1896.

The popularity of the Post Office savings banks was evidenced as soon as they were opened in 1882-3. The number of depositors in that year was 39,121, the amount at their credit was nearly 28 lakhs, and the interest which they received was Rs. 49,020. The corresponding figures for quinquennial years from 1885-6 to 1900-1, and for the year 1903-4, are :—

	1885-6.	1890-1.	1895-6.	1900-1.	1903-4.
Depositors . .	155,009	408,544	653,872	816,651	987,635
Amount of deposits (in lakhs of rupees)	2,19	6,13	8,79	9,75	12,33
Interest (in lakhs of rupees) . . .	7	22	25	29	35

The minimum deposit that may be made is 4 annas, and no sum is received which includes a fraction of an anna. The annual limit of current deposits is Rs. 200, and the maximum total amount which a depositor may have at his credit, at call, is Rs. 2,000, exclusive of interest. Interest was formerly allowed at the rate of a $\frac{1}{4}$ anna a month on every complete sum of Rs. 6, equivalent to $3\frac{1}{8}$ per cent. per annum. From July 1,

1905, this has been reduced to 3 per cent. on deposits held at call, but raised to $3\frac{1}{4}$ per cent. on deposits requiring six months' notice of withdrawal.

Any person, whether previously a depositor or not, may invest in Government securities, through the Post Office, any sum in whole rupees not being less than Rs. 10, to an amount not exceeding Rs. 1,000 in any one year, provided his total investment in and through the Post Office, including his current deposit account but exclusive of interest, does not exceed Rs. 5,000. The securities purchased for a depositor may, at his option, be kept by himself or by the Comptroller-General on his behalf. The Post Office receives no remuneration for its savings bank business, and it bears all incidental expenses, including the cost of the local and audit establishments.

Statistics as regards depositors.

The following table shows, as regards each postal Circle for the year 1903-4, the amount of savings bank deposits per 100 of the population, with a classification of the depositors according to occupations :—

Postal Circles.	Deposits per 100 of population.	Classification of Depositors.						
		Professional with fixed income.	Professional with variable income.	Domestic.	Commercial.	Agricultural.	Industrial.	Indefinite.
	Rs.							
Bengal . . .	53	55,654	12,103	24,431	8,537	3,453	4,761	98,571
Eastern Bengal .	47	10,630	4,088	5,040	1,114	308	816	23,850
Bihār . . .	21	14,009	2,364	5,041	856	1,261	915	17,429
Bombay . . .	141	50,171	8,713	22,327	8,189	1,713	6,960	92,072
Madras . . .	20	45,634	9,445	21,638	8,863	4,610	7,230	55,702
United Provinces .	27	29,536	8,355	32,079	3,302	2,799	2,482	39,176
Punjab and Frontier Province . .	48	25,055	8,363	29,179	3,226	1,142	3,529	29,539
Assam . . .	39	4,491	2,043	3,372	911	533	491	6,482
Burma . . .	36	7,840	1,371	17,435	1,152	186	2,864	11,082
Central Provinces .	27	9,166	1,458	5,807	853	267	1,253	11,367
Rājputāna . .	21	5,308	1,042	3,307	355	49	431	6,198
Sind and Baluchistān	96	6,482	1,262	5,946	572	110	870	9,013
Total	44	263,976	60,607	175,602	37,930	16,431	32,602	400,487

The Post Office savings banks made rapid progress at first; but the lowering of interest in 1894-5 from $3\frac{3}{4}$ to $3\frac{1}{8}$ per cent., and the reduction in 1889-90 of the annual and total amounts allowed to be deposited in cash to the credit of an account from Rs. 500 and Rs. 3,000, respectively, to Rs. 200 and

Rs. 2,000, checked for a time the normal increase of both accounts and balances. Although the banks have as yet relatively few cultivators among their constituents, the amount of each year's deposits varies regularly with the prosperity of the country. Thus, in the famine year 1897-8 the deposits fell by 23 per cent. and the closing balance by 3·6 per cent. In 1903-4 the depositors numbered 1 out of 286 of the total population, against 1 out of 4½ in the United Kingdom; and the amount at credit of depositors was nearly 7 annas per head of the population, against £3 9*s*. 1*d*. per head in the United Kingdom.

Life insurance.

Though the Indian Post Office has not yet established any system of life insurance open to the general public, it has an insurance branch from which any Government servant subject to civil rules can obtain a life insurance or endowment policy up to Rs. 4,000 or an annuity up to Rs. 50 a month. The scheme was started in 1884 for the benefit of Postal servants, and it was extended in 1888 to the Telegraph department, and in 1898 to all other Government civil establishments. Of 8,414 active policies at the close of 1903-4, 3,074 were life, and 5,340 endowment, policies.

Payment of military pensioners.

In April, 1890, the Post Office undertook, as an experimental measure, to pay native military pensioners resident in twenty-one Districts of the Punjab, and the system was extended in 1894 to the whole of that Province, including the Districts now transferred to the Frontier Province. The pensioners are thus saved from having to travel long distances twice a year to one of the places visited by a pension paymaster. The number of military pensioners paid by the Post Office in 1903-4 was 29,959, and the total amount of the pensions paid to them was more than 21 lakhs.

Sale of quinine by post offices.

At the instance of the Bengal Government, the Post Office undertook, in 1892, to act as an agency for the sale of quinine produced at the Government factory. The measure was introduced tentatively, and the drug was placed on sale at post offices in 5-grain powders at ¼ anna apiece, the postmasters being given a commission of 1 anna in the rupee on sales. On the experiment proving successful, the measure was gradually extended to the whole of India. The quinine supplied to post offices amounted in 1896-7, the first year in which the measure was in force throughout India, to 2,715 lb., and by 1903-4 it had risen to 5,121 lb., or more than 7,000,000 5-grain powders. The amount sold for ¼ anna is now (1905) 7 grains.

II. Telegraph Department[1]

In 1851 Dr. W. B. O'Shaughnessy, Assistant-Surgeon and Professor of Chemistry in the Medical College at Calcutta, obtained sanction to construct experimental telegraph lines along the Hooghly from Calcutta to Diamond Harbour, with a branch from Bishtopur to Māyāpur, and an extension from Kukrāhāti (on the farther side of the Hooghly) to Kedgeree, making, with some short additional sections, a total of 82 miles. In the same year, four offices (Calcutta, Māyapur, Bishtopur, and Diamond Harbour) were opened for business, which was principally connected with shipping, and two others (Kukrāhāti and Kedgeree) were added in February, 1852. The receiving instrument was a small galvanoscope, designed by Dr. O'Shaughnessy and made in India, and this pattern continued in use until the Morse instrument replaced it early in 1857.

Experimental telegraph lines in Bengal.

On these experimental lines proving successful, Lord Dalhousie obtained sanction from the Court of Directors for the construction of lines from Calcutta to Agra, Agra to Bombay, Agra to Peshāwar, and Bombay to Madras, extending in all over 3,050 miles and including forty-one offices. These were opened for paid message traffic in February, 1855. By 1857 the lines had been further extended, bringing Mysore, Ootacamund, and Calicut into the system, which then comprised 4,555 miles of wire, with sixty-two offices open to the public. During the Mutiny the lines in the then North-Western Provinces, and in parts of Central India, suffered considerable damage, about 760 miles being entirely demolished. But the Telegraph department was still able to render notable service in connexion with the suppression of the outbreak; and the fact that nearly 2,000 miles of line were constructed during the following year, in addition to the reconstruction of the lines destroyed, shows that the political value of the telegraph was by that time fully appreciated. Since then the department has steadily expanded year by year. At present its lines and operations extend from Mastūj in the north to Kolachel at the extreme south of India,

Extension of telegraphs.

[1] The use of the word 'telegraph' is now confined to electric telegraphy. In former times, however, the word was applied to the method of signalling messages by means of a semaphore, of which the most notable example was the Admiralty telegraph from Portsmouth to London during the French War. Early in the nineteenth century (1820-30), the proposal was seriously entertained by the Indian Government to construct a series of towers for semaphore signalling, 100 feet high and at intervals of 8 miles, all the way from Calcutta to Bombay. The scheme never went very far, though some of the towers then built may be seen to this day in Hooghly District.

and from Robāt Kila on the Perso-Baluchistān frontier to Kengtung in the extreme east of Burma.

Telegraph Acts.

The first Telegraph Act for India was Act XXXIV of 1854. The Acts which have since been passed, each repealing its predecessor, are VIII of 1860, I of 1876, and XIII of 1885. These Acts deal with the privileges and powers of Government in respect to telegraphs and other cognate matters. Rules and regulations for the acceptance, transmission, and custody of telegrams are published from time to time in the *Gazette of India*.

Present organization of the department.

The strength of the Telegraph establishment on March 31, 1904, is shown below :—

Chief Officers of the Offices of Direction, Accounts, and Superintendence	34
Assistant Superintendents, Sub-Assistant Superintendents, and Foremen of Workshops	146
Traffic Sub-Assistant Superintendents, Telegraph Masters, and Signallers	2,361
Clerks and Subordinates	8,000
TOTAL	10,541

The control of the department, which is now (1905) under the new Commerce and Industry Department of the Government of India, is vested in a Director-General, assisted by a Deputy and two Directors. The latter are in charge of the Traffic and Construction Branches respectively, and are each assisted by a Deputy Director, and in the case of the Traffic Branch by a Superintendent also.

The department comprises twenty divisions, each under a Superintendent directly responsible to the Director-General. Each division includes a number of subdivisions, in charge of Assistant Superintendents or Sub-Assistant Superintendents, whose chief duties are the efficient maintenance of lines and supervision of offices, and the construction of new lines. The accounts of the Telegraph department are audited by an officer, styled Examiner of Telegraph Accounts, whose office is in Calcutta.

Main lines of internal communication.

The main lines of internal communication now are :—

1. Calcutta to Madras : via the East Coast.
2. Calcutta to Bombay : via Allahābād, Jubbulpore, and Bhusāwal; *or* via Sini, Nāgpur, and Bhusāwal; *or* via Allahābād, Agra, Jhānsi, and Bhusāwal.
3. Calcutta to Karāchi : via Agra and Hyderābād.
4. Calcutta to Simla : via Agra and Delhi.
5. Calcutta to Rangoon : via Akyab.

6. Calcutta to Mandalay: via Akyab and Rangoon; *or* via Gauhāti and Manipur.
7. Bombay to Madras: along the Great Indian Peninsula and Madras Railways; *or* along the Southern Mahratta and Madras Railways.
8. Bombay to Karāchi: via Ahmadābād and Deesa; *or* via Bhusāwal, Mārwār Railway Junction, and Hyderābād.
9. Bombay to Calicut: via Bangalore and Mysore.
10. Madras to Calicut: via Jalārpet and Podanūr.
11. Madras to Tuticorin, &c.: along the South Indian Railway.
12. Karāchi to Quetta: via Sukkur.
13. Karāchi to Lahore: via Multān.

Construction of lines and material employed.

The earliest telegraph line constructed in the neighbourhood of Calcutta (1851–2) comprised overhead and underground sections, and included the crossing of the Hooghly and Haldī rivers. The overhead portion consisted of an uninsulated iron rod conductor, $\frac{3}{8}$ of an inch in diameter and weighing 1,250 lb. per mile, in lengths of $13\frac{1}{2}$ feet welded together end to end. It was supported on bamboos, 15 feet high and 200 to the mile, coated with coal-tar and pitch, and strengthened at intervals by posts, eight or ten to each mile, of teak, *sāl* (*Shorea robusta*), or iron-wood. The conductor was secured to the posts by means of strong iron clamps. The underground line, used in Calcutta and its suburbs, had a conductor similar to that of the overhead line, protected with two layers of Madras cloth saturated with melted pitch and tar, and laid in a row of roofing tiles filled with a melted mixture of sand and resin. The river cables were of English-make gutta-percha-covered copper wire, which was secured, for protection against dragging anchors, in the angles of a $\frac{7}{8}''$ iron chain cable. One of these cables was laid across the Hooghly (2,070 yards) at Diamond Harbour, and another across the Haldī (1,400 yards) at Kedgeree.

The construction of the long lines from Calcutta to Peshāwar, Agra to Bombay, and Bombay to Madras, with some important branches, was begun in 1853. A lighter conductor was used for these lines, and the supports were generally of a more substantial character. In most cases spars of teak, *sāl*, fir, iron-wood, or black-wood (*Terminalia. elata*) were used either as entire posts, or in combination with iron screw-piles, or with pedestals or columns of masonry. Granite obelisks consisting of single slabs, 16 feet above ground, formed the supports on a length of 322 miles of the Bombay-Madras line, while in some localities toddy palms, with tops of *sāl* to provide insulation, were the only supports. Some of the lines had insulators,

made in India or obtained from England, while others were uninsulated. In 1856 iron tubes were introduced for portions of posts; and as the advantage of iron over wood for supports was more fully recognized, entire tubular iron posts of Hamilton's and other patterns were imported, and between 1861 and 1863 the lines were extensively reconstructed with these posts. The supports now used are chiefly tubular iron posts, or old iron rails purchased from the railways.

Various patterns of insulators have from time to time been adopted. The patterns now imported are principally those known as the 'O.P.P.,' 'Siemens' No. 38,' and Johnson and Phillips' oil insulators; but other special patterns are imported for telephones, and for town and field telegraph lines. The heavy iron rod at first used as a conductor was found difficult of manipulation, and lighter wires were gradually introduced. As the result of trials made between 1884 and 1886, hard-drawn copper wire was substituted for iron wire on some main circuits, and its use has been considerably extended of late. The conductors now used are chiefly iron wire of 600, 450, and 300 lb. per mile, and copper wire of 300 and 200 lb.

Telegraphs for railways and canals.

In 1873 the Telegraph department undertook the duty of supplying wires, instruments, and technical supervision to state railways, at fixed rates of rental. The same duties are undertaken for the telegraph service established in connexion with the canal systems of India; and wires are also provided on similar terms for all new assisted or private railways, the supply of instruments and the supervision of their offices being in this case optional.

Combined post and telegraph offices.

In 1883 an arrangement was made between the Postal and Telegraph departments, under which the latter constructs and maintains short branch lines to selected outlying post offices, and fits up instruments in them, the Postal department undertaking the working of the telegraph offices thus opened, while the technical and traffic supervision rests with the Telegraph department. The results of this system have been mentioned in the 'Post Office' portion of this chapter (*ante*, p. 433).

Telegraphs for military purposes.

The Telegraph department is also charged with the duty of supplying telegraph and telephone systems for military expeditions, and for use in connexion with the fortifications and defences of the country. It trains annually a large number of British soldiers in telegraphy, and employs in many of its offices a proportion of those so trained, thus maintaining a reserve of qualified military telegraphists for service in the field in time of war.

An installation for wireless telegraphy having been worked successfully for some time between Port Blair in the Andamans and Diamond Island on the Burmese coast, the route was opened to public traffic in September, 1905, and regular and perfect communication in ordinary circumstances is thus maintained with the Andaman Islands. Wireless telegraphy.

The following are the dates on which the existing telegraph connexions with countries outside India were opened to traffic:— Communication with other countries.

India to Ceylon, 1858.
Indo-European route to United Kingdom, via Turkey, 1865.
Indo-European route to United Kingdom, via Teherān, 1870.
Eastern Company's route, Bombay to Aden, 1870.
Suez route to United Kingdom, 1870.
Eastern and South African Company's route from Aden to Durban (Natal), via Zanzibar, Mozambique, and Lourenço Marques, 1879.
Eastern Extension Company's route from Madras to Penang, Singapore, and Batavia, 1871.
Batavia to Port Darwin (Australia), 1872.
Singapore to Hongkong, 1871.
Hongkong to Shanghai, 1871.
Great Northern Company's route from Shanghai to Nagasaki, 1871.
Nagasaki to Vladivostock, 1872.
Bhamo route to China, 1895.
Moulmein to Bangkok, via Amya, 1883-4.
" " via Myawaddy and Raheing, 1886-7.

The Indian Telegraph department transfers telegrams to the Indo-European Telegraph department at Karāchi; to the Eastern Telegraph Company at Bombay; and to the Eastern Extension, Australasia, and China Telegraph Company at Madras; while it has wire connexions with the Chinese Imperial Telegraphs at Nampaung in the Bhamo District, and with the Siamese Telegraphs at Myawaddy and at Sinbyoodine. It also interchanges traffic with the telegraphic systems of Ceylon and Portuguese India, and of the Kashmīr State. The connexions with China, Kashmīr, and Portuguese India are worked under special agreements; the other connexions under the International Telegraph Regulations.

All telegrams on the service of the state are paid for, except those relating to the service of the Postal and Telegraph departments. Payment for service telegrams.

When, in 1855, the lines of the department were first opened for telegrams from the public, the tariff was fixed at one rupee for each sixteen words (including the address) for transmission over 400 miles of telegraph line, and a double charge was Inland tariffs.

levied on telegrams presented between 6 p.m. and 6 a.m. After several experimental modifications, a revised tariff was introduced in January, 1882, under which the charge was made uniform for all hours of the day and night and for any distance, and the address was signalled free in all cases. For the purpose of this tariff, telegrams were, after 1886, divided into three classes: Urgent, Ordinary, and Deferred. The charge for an Ordinary telegram was one rupee for eight words and 2 annas for each additional word. Urgent telegrams were charged at double, and Deferred telegrams at half, the rate for Ordinary telegrams. From the 1st of January, 1904, the tariff was again reduced. In the case of Ordinary and Urgent telegrams the number of words for the minimum charge of R. 1 and Rs. 2 was raised from eight with a free address, to sixteen including the address. The charge for Deferred telegrams was 4 annas for four words, with 1 anna for each additional word, and the address up to six words was signalled free. During the calendar year 1904 there had been an increase (as compared with 1903) of 43 per cent. in the number, and of 7·6 per cent. in the value, of private Deferred messages, largely owing to this change of tariff. From July, 1905, the address of Deferred messages has no longer been signalled free, but ten words, including the address, may be sent for the minimum charge of 4 annas.

Foreign tariffs. United Kingdom.

The original tariff for messages between India and the United Kingdom was £5 per twenty words. This was reduced at the Vienna International Telegraph Conference (1868) to £2 17*s.* 6*d.* In 1871 this tariff was raised, at a special Conference at Berne, to £4 10*s.*; and at the St. Petersburg Conference of 1875 a word-rate was established, which was fixed at 5½ francs via Suez or Teherān and 5 francs via Turkey. In 1879 these rates were somewhat raised, but at the Berlin Conference of 1885 they were reduced to 5 and 4½ francs respectively. In March, 1902, the rate per word via Suez or Teherān was reduced to 2*s.* 6*d.*, and in August, 1905, was further reduced to 2*s.* The rate per word via Turkey, which was 2*s.* 3*d.* since January, 1903, was also reduced at the same time by 5*d.*

Foreign countries generally.

The tariffs for foreign countries, being made up of the shares of the different Administrations concerned, are liable to vary in accordance with the alterations in rates made by them, as also with the route employed. Tables showing these are given in the *Indian Telegraph Guide*, published quarterly. Ceylon is, for telegraph purposes, a Foreign Administration, and telegrams to that colony are charged at 3 annas a word from India and 4½ annas from Burma.

Press and Government telegrams.

Press telegrams enjoy the privilege of dispatch at a far lower rate than is allowed for ordinary private messages. Thus the charge for an inland press Deferred message is about one-sixth of that usually levied, and for a foreign press message about one-third. Government telegrams, on the other hand, are charged at the same rate as ordinary private messages.

Telegraph stamps.

Telegrams tendered at offices of the Telegraph department are stamped to the requisite amount with special telegraph stamps; those tendered at combined post and telegraph offices may be prepaid in either telegraph or postage stamps. Certain post offices which are not telegraph offices are empowered to receive telegrams from the public and to grant receipts for them. Such telegrams are transmitted by post to the nearest telegraph office for dispatch.

Growth of telegraph transactions.

The table in the Appendix (p. 445) shows the growth of the operations of the Indian Telegraph department between 1860–1 and 1903–4. In the first-mentioned year about 11,000 miles of telegraph line were open, with 145 telegraph offices. In 1903–4 there were nearly 60,000 miles of line, with 2,127 offices, which dealt with more than 7,250,000 messages, of which nearly 6,500,000 were for the public. The net revenue earned by the department showed a profit in that year of 3·7 per cent. on its capital outlay. But taking into account home charges, including those of the Indo-European Telegraph department, which is referred to later on, and which is entirely distinct from the Indian Telegraph department in respect of administration, the net result in 1903–4 was (approximately) a loss of 9 lakhs to Government in respect of Telegraphs.

Telephone exchanges and private lines.

In 1881 and 1882 the Government of India granted to the Oriental Telephone Company licences to establish telephone exchanges at Bombay, Madras, Calcutta, Karāchi, and Rangoon. At the same time permission was given to the company to erect private lines, each under a separate licence, in the localities covered by the exchange licences. But the Government of India expressly reserved full power to erect exchanges itself, for its own purposes anywhere, and for the public in any place for which no licence had been granted to a private company. It also reserved the power to grant licences to more than one company. The Oriental Telephone Company has transferred its licences for Calcutta, Bombay, and Karāchi to local companies, and licences have been subsequently granted for exchanges at Moulmein and Ahmadābād.

The Telegraph department supplies telephone exchanges and private telephone lines for the use of the various depart-

ments of Government; and, where the requirements of the public in this direction cannot be met by private companies, it also undertakes the provision of telephones for municipalities and other local bodies, as well as for private customers. The following figures show the extent of the departmental operations in telephone work, excluding systems supplied for the use of railways or canals:—

YEAR.	No. of exchanges.	No. of exchange connexions.	No. of private line offices.	Amount of yearly subscriptions.
				Rs.
1882	8	56	147	40,069
1890	13	93	224	53,794
1900	46	401	555	1,61,127
1903	71	838	708	1,95,692

Indo-European Telegraph department.

The Indo-European Telegraph department has charge of that portion of the system of telegraphs between England and Karāchi which is owned by the Government of India. It includes: (i) The Persian Gulf section, which runs from Karāchi to the head of the Persian Gulf, and connects the Indian telegraph lines, which terminate at Karāchi, with the Persian section at Bushire and the Turkish telegraphs at Fao. The system consists of one cable and an overhead line from Karāchi to Jask, about 660 miles west of Karāchi, and of cables thence to the head of the Persian Gulf. There is also a cable from Maskat which connects with the system at Jask. (ii) The Persian section, which runs from Bushire, through Shirāz and Ispahān, to Teherān, consists of an overhead line worked under a concession from the Persian Government. The duties of the Persian section include the maintenance of the Persian Government line from Teherān to Meshed, and of the line now being constructed from Kashān to the Baluchistān frontier, via Yezd and Kermān.

The Indo-European Telegraph department is under the direct control of the Secretary of State for India, and is administered by a Director-in-Chief who has his head-quarters in London. The Persian Gulf and the Persian sections are each under a Director, with head-quarters at Karāchi and Teherān respectively.

APPENDIX

STATISTICS OF THE INDIAN TELEGRAPH DEPARTMENT FOR THE YEARS 1860–1, 1870–1, 1880–1, 1890–1, 1900–1, AND 1903–4

YEAR.	Mileage of lines.	NUMBER OF OFFICES.			Number of telegrams.	VALUE OF TELEGRAMS (IN LAKHS OF RUPEES).			Total receipts (in lakhs of rupees).	Working expenses (in lakhs of rupees).	Total capital expenditure to the end of the year (in lakhs of rupees).	Percentage of net revenue on capital outlay.
		Departmental.	Postal and Telegraph combined.	Total.		State.	Other.	Total.				
1860–1 . .	11,093	145	..	145	*	1	5	6	6	14	65	..
1870–1 . .	13,534	197	..	197	581,234	1	12	13	13	24	2,36	..
1880–1 . .	20,346	254	..	254	1,658,647	13	26	39	45	32	2,55	5·2
1890–1 . .	37,070	260	689	940	3,409,661	11	41	52	68	47	5,02	4·3
1900–1 . .	55,055	248	1,691	1,939	6,462,278	24	70	94	1,15	71	7,09	6·2
1903–4 . .	59,692	268	1,859	2,127	7,318,390	19	67	86	1,11	81	8,32	3·7

* Figures not available.

Bibliography

For further information on the matters dealt with in this chapter, see the annual Administration Reports of the Postal, Indian Telegraph, and Indo-European Telegraph Departments, which are published in the *Gazette of India*; the Postal and Telegraph *Guides*, published officially every half-year and every quarter respectively; and the 'History of the Indian Telegraph Department,' 1851–91, by Mr. P. V. Luke (vol. xx, *Journal of Institution of Electrical Engineers*); *Report on the European Telegraph Department, being a History of the Department from* 1863 *to* 1888, by Colonel H. A. Mallock (Calcutta, 1890); also the *Official History of the Mekrān Telegraph Line from Karāchi to Jask* (Karāchi, 1895).

CHAPTER IX

RENTS, PRICES, AND WAGES

I. Rents

Origin and development of Indian rents.

INDIAN rents have had a history very different from that of rents in Europe. Throughout the periods of native rule for which we have historical data, the prevailing custom was for the cultivator to deal direct with the representative of the state, and the whole of the economic rent passed straight from one to the other. Even when there was an intermediary, and when that intermediary enjoyed to a greater or less degree the other incidents of proprietary right, he seldom received any substantial share of the profits of cultivation, and such dues as he might intercept would more fittingly be classed as fees or perquisites than as rent in the proper sense of the term. As the several Provinces passed under British rule, the Government at first continued the native practice of taking as land revenue the whole, or nearly the whole, of the economic rent. When the intermediaries were few or weak the Government dealt direct with the cultivator; and it still does so in what are called the 'ryotwāri' areas, which include Bombay, Burma, Assam, and the greater part of Madras. Where, on the other hand, the intermediaries were numerous and powerful, as in the zamīndāri tracts of Bengal and the United Provinces, the Government dealt with those intermediaries, leaving them to collect the rents from the cultivators and, when paying the proceeds to the state, to retain a small proportion, generally 10 per cent., for their own use. It is from this percentage that the payments now representing the net rental have developed, and the development has been along two main lines of expansion. In Bengal the Government demand, representing at the time of its assessment 90 per cent. of the economic rent, was fixed in perpetuity in 1793; but the extension of cultivation, and the rise in the value of produce, since that date have been so considerable that the Government revenue at the present day is estimated to absorb no more than 25 per cent. of the

economic rental, leaving 75 per cent. to be enjoyed as a net rent by the landlords or other parties who now stand between the cultivator and the state. In the other Provinces the Government demand has not, as a rule, been fixed in perpetuity, and is liable to revision at intervals of twenty to thirty years[1]; but owing to the gradual influence of Western views regarding the character and political value of proprietorship in land, the state has by degrees reduced its share of the profits from 90 per cent. to a maximum of about 50 per cent., leaving the remainder as a substantial net rental in the hands of the persons whom it has recognized as landowners. The peculiarity of Indian rents lies therefore in this fact, that whereas in most countries the land revenue is an assignment from the rent made by landowners to the Government, in India the net rent is, historically speaking, a relinquishment of part of the profits of land by the Government to the landowners.

The Rent Act of 1859. 'Occupancy' and 'non-occupancy' tenants.

During the first half of the nineteenth century, while the incidence of the land revenue was still high and land of much less value than now, the rent question, though frequently discussed, was not looked upon as one of special urgency. But as population increased and the competition of tenants for land became more keen, it was felt that some system should be prescribed by law to guide the landlords and the courts in matters of enhancement and eviction, and with this object Act X of 1859 (India) was passed for the regulation of rent questions in Bengal, Agra, and the Central Provinces. In dealing with the tenants this Act reproduced and crystallized a distinction which had, in a vague and indeterminate manner, governed the treatment of cultivators under the native régime. It may be said generally that under native rule the cultivator was never ousted from his holding so long as he paid the dues expected from him; and although there was nothing in law or theory to prevent the indefinite enhancement of such payments, the cultivators were so few and so valuable that in practice the enhancements seldom exceeded the full economic rent. In addition, however, to the cultivators so treated, there was always a class of men who were on a more temporary footing—men who came from outside villages or constantly wandered from place to place; and it was felt that as regards these men the same customary obligation did not apply. The Act of 1859 accordingly divided the tenants, on the above lines, into 'occupancy' and 'non-occupancy,' and gave to the former a greater degree of protection than to the latter. In

[1] See Vol. IV, chap. vii, Land Revenue.

distinguishing the two classes the principle of prescription was followed as the best practical guide, and the continuous cultivation or holding of land for twelve years was declared to entitle the tenant to a 'right of occupancy' in the land so cultivated or held.

Subsequent legislation in zamindāri Provinces.

A similar distinction was preserved in various local Acts passed subsequently to 1859, but as time went on the protection thus afforded to tenants was found to be inadequate. The inquiries of the Famine Commission in 1880 showed that in many tracts the rents were too high; that the cultivators were by the conditions of their life debarred from other means of subsistence; and that the pressure of high rents entailed a great deal of unnecessary poverty, and consequent inability to withstand the attacks of famine. The subject had meanwhile attracted special attention in Bengal, where the whole question was threshed out with great thoroughness and no little acrimony, and a Bengal Act representing the result of these inquiries was passed in 1885. This Act has been accepted in many respects as the standard of rent legislation for India, and, along with the recommendations of the Famine Commission of 1880, has led to the gradual revision of the rent legislation of other Provinces. In Oudh, where the land is mainly owned by large proprietors in an exceptionally strong position, and in the Punjab, where the owners are small farmers and only half the land is let to tenants, the Provincial legislation has certain local peculiarities; but in Bengal, Agra, and the Central Provinces, though the specific provisions of the laws differ, there is a general similarity in their outline.

Present rent laws. Classes of tenants.

The position of rent legislation in India at the present time may be briefly described as follows:—In all the Provinces above mentioned the law recognizes the two main classes of tenants already referred to, occupancy and non-occupancy[1]. As regards the qualification for occupancy rights, a twelve-year rule is now followed only in Bengal and the Province of Agra. In Oudh rights of occupancy were granted to certain classes of ex-proprietors only, and in the Punjab they can be claimed on certain specified historical grounds, but not on mere lapse of time. The twelve-year rule was in force in the Central Provinces till 1884, but was in that year superseded by a provision which

[1] Other classes of tenants are also recognized in several Provinces, under the names of tenure holders, tenants at fixed rates, absolute occupancy tenants, &c., at one end of the scale, and sub-tenants at the other; but the bulk of the rent legislation is concerned with the two classes mentioned in the text.

allows the purchase of occupancy rights by an ordinary tenant at two and a half times the annual rental. In the Province of Agra, where the old rule of prescription is still retained, special precautions have been taken to prevent the deliberate shifting of tenants by the landlord to defeat their claims, and the tenant's continuous possession is held not to be disturbed by re-distribution or exchange of holdings. In Bengal a further step has been taken, and every tenant who has continuously held land in a village for twelve years has a right of occupancy in all land that may at any time be held by him in that village.

Enhancement of rents.

Landlord's improvements, or an increase in the area of the holding, are everywhere accepted as proper grounds for enhancement. An occupancy tenant's rent can generally (subject to certain restrictions) be enhanced by contract, but in some Provinces the interposition of a Government officer is in any case required. When an enhancement is made on suit or application, it is subject to certain prescribed limitations. The Act of 1859 allowed enhancement up to the prevailing standard of occupancy rents in the neighbourhood, or up to the limit indicated by a rise in the value of produce; and this, with some later modifications, is still the rule in force in Bengal and the Province of Agra. In the Central Provinces enhancements not exceeding 25 per cent. may be made if the rent fixed at the last land-revenue settlement was less than the full rent assessable, or if there has been a rise of prices since the settlement. In Oudh a rise of prices is not taken into consideration, but in enhancements regard is had to the prevailing occupancy standard, or to a certain proportion of the prevailing non-occupancy rates in the neighbourhood. In the Punjab neither of the old rules of 1859 is now followed, and the occupancy rents are limited to a standard based on the land revenue and varying from one-eighth to three-fourths in excess of the assessment. In all Provinces where the land revenue is subject to periodical re-assessment, the rent can be altered at the time of the revenue settlement; otherwise an occupancy rent once fixed is unalterable (except on the ground of change of area or landlord's improvements) for a further period of five, ten, or fifteen years as the case may be, the term being shortest in Oudh and longest in Bengal.

The protection accorded to a non-occupancy tenant is of course less than that above described, but his rent is not, except in the Punjab, left entirely to the discretion of the landlord. The Bengal Act allows a tenant who sues against

enhancement to have a fair and equitable rent fixed for him on the basis of the prevailing rates, and the law in the Province of Agra allows a similar privilege to tenants who have held on a seven years' lease. In Oudh an enhancement, whether agreed to on contract or awarded on a suit, may not exceed $6\frac{1}{4}$ per cent. of the existing rent, and the corresponding limit in the less developed Central Provinces is 33 per cent. A special feature of the law in the Central Provinces is that an officer re-assessing revenue is required to fix the rents of all non-occupancy tenants; and a general revision of rents on a somewhat similar system can, if necessary, be set in motion by the Government in the Province of Agra and in Bengal. A non-occupancy rent once fixed is generally protected from further enhancement for a term of five or seven years.

Abatement of rents.

An abatement of rent can be adjudged, generally speaking, on conditions inverse to those permitting of judicial enhancement, and in cases when a Government officer is invested with general powers to fix fair rents he necessarily has the power to reduce rents which are excessive. In some Provinces the courts possess, to a certain extent, power to remit rent when the produce has been injured or destroyed by natural causes; and in the temporarily settled Provinces a suspension or remission by Government of its revenue entails, or is conditional on, a corresponding suspension or remission of the rent.

Recovery of arrears.

Lastly, as regards the recovery of arrears, the general tendency of modern legislation in India is to reduce the landlord's summary powers of recovery, while simplifying the procedure of recovery through the courts. The special processes of ejectment and distraint are now subjected to considerable safeguards against possible oppression. As a general rule, both occupancy and non-occupancy tenants can be ejected for arrears; but the ejectment must be by notice or suit, and the procedure must be in accordance with the conditions laid down by the legislature. In Bengal and the United Provinces the landlord has also a remedy by distress, but his powers are far less extensive than they were under the old Bengal Regulations. The distraint is confined to the crops of the holding in arrear; reaping and threshing may not be interfered with; the arrear for which distraint is made must be of recent origin; and the distraint must either be made through a court or reported at once for the court's information. In the Central Provinces and the Punjab there is no actual power of distraint; but in the former Province crops can be attached pending a decree for the arrears, and in the latter, if

the produce be already attached, the rent can be recovered therefrom.

Rent in ryotwāri Provinces.

The above represents briefly the present condition of the law regarding rents in Northern and Central India[1]. In the 'ryotwāri' areas, where the Government deals directly with each occupant of land, and where large proprietors have either disappeared or never existed, the land is cultivated to a much larger extent by the landholders themselves and rents are far less prevalent. The fact that the Government revenue generally falls far short of the economic rent has, however, led to a certain amount of subletting in the ryotwāri areas; and although in most of these Provinces the legislature has hitherto exercised little or no interference in rent matters, the increasing tendency to sublet gives rise to the presumption that the position of sub-tenants in ryotwāri tracts will before long be subjected to more detailed control than has hitherto been the case.

Rents paid in kind.

Speaking generally, the legislative provisions already discussed deal primarily with cash rents. The original form of rent in India is, however, a kind-rent, taken, as a rule, in the form of a share of the grain heap. The inconveniences connected with this primitive phase of rent led to various developments, such as the division of the standing crop by appraisement, or the payment of the landlord's share of the grain at a stipulated price-rate; or, if the crops were difficult or inconvenient to divide, a cash rate per acre would be paid on them, or a cash rate per acre might be taken on the entire holding; or, finally, a lump sum in gross would be assessed on the tenancy as a whole. The payment of rent in kind is, however, still exceedingly common in all parts of India. Generally speaking, it is prevalent in tracts where the country is yet undeveloped, or where the crops are liable to extreme variations of out-turn, or where the tenants are much depressed; but there are marked exceptions to these general statements, and the adoption of a cash or produce basis for rental is largely a matter of custom. The produce system has both disadvantages and merits: it opens the door

[1] In portions of the Madras Presidency also, where there are large proprietors holding under a permanent land-revenue assessment, such proprietors are bound, by an Act passed in 1865, to enter into mutual written agreements with their tenants as a preliminary to the grant of assistance by the courts in distraint, eviction, &c.; and the courts, in dealing with suits to enforce such written agreements against a tenant, are enabled to adjudicate on enhancements of rent. An improved and more elaborate Rent Act for Madras is at present (1905) under consideration.

to much fraud, uncertainty, and oppression; but on the other hand, it apportions the rent exactly to the produce, and thus avoids the severity with which a fixed cash rent must fall upon a tenant in years of scarcity. Where kind-rents prevail, many of the questions with which the rent laws concern themselves disappear from view. Enhancements and abatements, for instance, due to changes in area, to improvement and deterioration, or to the rise and fall of prices, adjust themselves automatically. Otherwise, and with some necessary modifications, the provisions of the rent laws apply generally to produce-rents as well as to those in cash; and there are usually special conditions providing that disputes about the division or appraisement of the crop shall, on the application of one of the parties, be decided by a revenue officer, and that under certain circumstances a kind-rent may, by the same agency, be converted into one in cash. There are no general statistics regarding the expansion or contraction of the area under kind-rents; but it is usually believed that, taking India as a whole, the system of cash rents is slowly gaining ground concurrently with the general development of the country.

Rent statistics.

Detailed statistics regarding rent are not, as a rule, available for any but small areas, and in Bengal they are almost entirely wanting. The following table collects the chief data of interest for the zamīndāri Provinces according to recent returns:—

	Bengal.	Agra.	Oudh.	Punjab.	Central Provinces.
Average area held by proprietor (in acres)	59	16	71	16	335
Average area of tenant's holding (in acres)	*	*	*	2.8	11.8
Percentage of total cultivated area held by tenants	*	78.9	87.8	54.1	77.1
Percentage of rented area held by tenants enjoying occupancy or equivalent rights	*	45.4	6.3	19.9	59.5
Percentage of grain-rented area to total rented area	*	6.2	19.8	56.6	*
Incidence of cash rents per cultivated acre (in rupees)	3.5	4.2	5.2	3.7	0.7

* Information not available.

The figures require certain reservations and explanations which need not be entered into here; but they may be accepted as showing with sufficient accuracy the general conditions connected with rent in India. With reference

to the incidence of the cash rental, it may be observed that the rent of protected tenants is in some Provinces maintained by law at a standard below that of tenants-at-will, while in other Provinces it is not so restricted, and may even, owing to the occupancy tenants' possession of the best lands, be higher than the prevalent non-occupancy rate.

Influence of custom on rents.

As to the incidence of the rents generally, this may be said to depend on the interaction of three forces—custom, competition, and legislation. In the early days of British rule custom was everywhere paramount, and even now the influence of competition is comparatively restricted. A rise of prices, for instance, even in unfettered tenancies, does not necessarily entail a concurrent rise in rents: the rental in such cases rises, as a rule, considerably after prices and by no means in exact conformity with them. The rent legislation of India has this special characteristic, that it starts from a basis of custom and, while accepting the legitimate influence of competition, seeks to confine that influence within reasonable limits. It aims not so much at the curtailment of advantages naturally accruing to landlords, as at the maintenance of rights already conferred on tenants by custom. Custom is therefore still, to a large extent, the foundation of Indian rents, and the presumptions of unfettered competition, which pervade the standard economic conceptions of rent, can only be applied with large reservations to existing conditions in India.

II. Prices and Wages

Retail Prices

The data available. Early records.

No records exist of prices in the interior of the country except for the staple food-grains and salt, which are the articles most commonly bought and sold. Since 1873 these prices have been reported in fortnightly returns from most Districts, and have been regularly published in the *Gazette of India*. From these, and from earlier local returns, a compilation of each year's prices is made, which has, since 1884, been published annually in the official publication entitled *Prices and Wages in India*, the record of prices commencing with the year 1861. For previous years the information becomes more and more incomplete the farther back the inquiry is carried, and is not wholly to be depended on, though various official records exist of prices in such periods. Thus, in a report on wages and prices during the years 1858–70, published

in 1871 by the Government of the United Provinces, a statement, obtained from merchants' books, is given of the price of wheat at Bareilly from 1805, at Ghāziābād from 1831, and at Sahāranpur, Muttra, and Aligarh from 1840. Old prices are also obtainable from settlement reports and local gazetteers. The *Bombay Gazetteer* gives prices of millet at Broach from 1782 in broken periods, and continuously from 1810; at Bhaunagar from 1783, with but few omissions; and for several other places from the early years of the nineteenth century. These prices, with those of rice in Kanara and Madras, from 1824 and 1811 respectively, were averaged, and illustrated with a series of diagrams, by Mr. Chambers, Meteorological Reporter for Western India, in a paper, written in April, 1886, on the variations of prices in the Bombay Presidency, which examines the possible connexion between price variations and the periodicity of sun spots. Similar variations over a long series of years, starting from the early part of the nineteenth century, were given in tabular and diagrammatic form by Mr. Pedder of the India Office, in a memorandum on prices embodied in the Parliamentary Blue Book exhibiting the 'Moral and Material Progress of India' in 1882–3, the grains selected being in this case *bājra* (*Pennisetum typhoideum*), *jowār* (*Andropogon sorghum*), wheat, and rice, at four typical marts. The salient feature of all these price statements is the same: namely, the immense variation of prices between years of good and bad harvests which resulted from the absence of trade and communications, except in the maritime Districts of Western India, which were opened to trade in very early times and where the fluctuations were consequently within much narrower limits. The isolation of many Districts before the opening up of the country by railways and roads deprived them of any outlet for their surplus in times of plenty, and in periods of scarcity or famine made them depend wholly on their own supplies. Thus, an abundant harvest produced prices which, according to modern standards, seem extraordinarily low, while a failure of the crops meant a range of prices proportionately much higher than can now be reached, or caused heavy mortality from starvation. Among several examples of the levelling effect on prices of improved communications, Mr. Pedder cites the following case. In 1838 there was a severe famine in the United Provinces, and the price of wheat at Agra rose to 13½ seers[1] per rupee, while at Khāndesh the price of *jowār* was as low as 61 seers. In 1861 and 1869 there were

[1] A seer is about 2 lb.

again famines in the United Provinces and no failure in Khāndesh. But the railway had meanwhile brought Khāndesh into direct communication with Agra, and when the price of wheat in Agra was 14 and 12 seers per rupee the price of *jowār* in Khāndesh rose to 16 and $12\frac{1}{2}$ seers.

Rise of prices from 1860.

Other noticeable features are the tendency of prices to fall during the first half of the nineteenth century, and the marked rise which occurred about 1860, and which is attributed by Mr. Pedder to the great economic change introduced by the rapid growth of the export trade and the expansion of the circulating medium. Under native rule such limited trade as existed was mainly carried on by barter, and a large portion of the receipts and disbursements of the Government was in kind. The introduction, with British rule, of money payments to and by Government, the growth of trade, and the general increase of prosperity and production arising from peace and a settled administration, caused prices to drop until a rise was brought about by a large influx of silver, which allowed the currency to expand in a greater degree than the duties thrown on it.

Comparison of prices before and after that date.

In comparing early prices with those published from 1861, it must be remembered that the former, which are generally taken from settlement reports, are the harvest prices obtained by the cultivator, while the latter are the retail prices paid by the consumer. The harvest prices, besides being necessarily far lower than the retail figures, are no guide to the average price of the year, for the crop is often sold to a banker, grain-dealer, or merchant who has made advances and bargained for its purchase beforehand, at a price not likely to be unfavourable to himself. The grain trade as it now exists is quite a modern development, resulting from the establishment of ampler means of transport and communication; yet it is a common fallacy to compare modern prices, which approach to one level at all places accessible by railway, and which in times both of plenty and of acute famine are real commercial quotations, with the purely local figures formerly recorded in isolated tracts, where a bumper harvest produced nominal prices, and a complete failure, with the usual accompaniment of intense famine, made grain practically priceless.

Standard food-grains.

In considering the course of retail prices from 1861, it will be convenient to take the seven principal food-grains for which a complete record exists. In tabulating the figures, the average of the District prices for each Province, or part thereof, where the grain is largely grown for food, is taken from *Prices*

and Wages in India and formed into a general average; for although this method is doubtless open to some criticism, limitation of space compels its adoption. The grains and the Provinces are: Rice (common)—Bengal, Assam, Lower Burma, Madras, United Provinces, Central Provinces. Wheat—Punjab, United Provinces, Central Provinces, Bengal (Bihār), Bombay. Barley—Punjab, United Provinces, Bengal (Bihār). *Jowār* (*Andropogon sorghum*)—United Provinces, Punjab, Central Provinces and Berār, Bombay, Madras. *Bājra* (*Pennisetum typhoideum*)—United Provinces, Punjab, Madras, Bombay. *Rāgi* (*Eleusine coracana*)—Madras, Mysore, Bengal, Bombay. Gram (*Cicer arietinum*)—Punjab, United Provinces, Bengal (Bihār), Central Provinces, Bombay, Mysore.

Maize, *arhar* (*Cajanus indicus*), and *kakun* (*Setaria italica*) have been omitted, as the records of prices for these are more or less incomplete in the earlier years. Salt is also left out, as its price is chiefly regulated by the varying rate of duty and the cost of transport.

Method of expressing prices in India.

Prices are expressed, according to the usual Indian method, in terms of the number of seers sold for a rupee; and to avoid misleading conclusions by those accustomed to think of money prices, it is advisable to note that not only do money prices vary inversely to quantity prices, but that the percentages of the rise or fall of prices according to the two methods of notation are quite different. Thus, if the number of seers obtainable for a rupee is halved, i.e. decreases by 50 per cent., the money price is doubled, i.e. rises 100 per cent.; but if the quantity price becomes 50 per cent. more, that is cheaper, the corresponding money price is only 33 per cent. lower.

Statistics of retail prices, 1861–1903.

In the table on the next page, which gives averages for each quinquennium between 1861 and 1900, and for the three years 1901–3, quantity prices are used except in the last column, which states the variations in the estimated price of all grains from the price of a standard period. These variations are in inverse ratio to the quantity prices, and thus represent with approximate accuracy the course of money prices.

Prices of 1861–70.

Allusion has already been made to the general rise of prices which took place about 1860. With the suppression of the Mutiny and the transfer of the administration to the Crown, there commenced a new era of commercial and industrial activity, as the resources of the country were developed by the construction of roads and railways, the improvement of harbours, and the extension of irrigation. A momentous event of

this period was the American Civil War of 1861–5: this, by causing a cotton famine, gave an immense stimulus to the extension of cotton cultivation in India, which while the war lasted brought large profits to the cultivator and the merchant. The influx of the precious metals which began about the time of the Mutiny was thus still further stimulated, and a great rise

Quantities sold per Rupee in Seers and decimals of a Seer

AVERAGE FOR THE YEARS	Rice.	Wheat.	Barley.	Jowār.	Bājra.	Rāgi.	Gram.	General average.	Variation in money-price index, the price of 1871-5 being = 100.
1861–5 .	20.0	22.4	36.6	26.5	24.8	28.7	26.0	26.4	94
1866–70 .	16.1	16.2	27.1	21.9	19.9	26.5	18.4	20.9	119
1871–5 .	18.2	19.7	29.0	26.8	23.0	33.5	23.6	24.8	100
1876–80 .	14.5	16.9	27.3	21.1	19.3	20.4	19.9	19.9	125
1881–5 .	16.9	19.9	30.9	28.5	25.0	28.0	25.6	25.0	99
1886–90 .	14.7	16.3	24.7	21.5	19.6	26.9	19.8	20.5	121
1891–5 .	12.7	14.9	22.7	20.1	18.0	22.3	18.5	18.5	135
1896–1900	11.7	12.1	18.4	16.5	15.3	18.3	13.5	15.1	164
1901–3	11.6	14.5	21.9	20.6	19.1	20.5	16.5	17.8	139

of prices ensued, from about the second year of the war, throughout the cotton-growing districts of Western and Central India, extending in a less degree to other parts of the country. Prices were also raised by the famine of 1861 in the Upper Doāb of the Province of Agra and the neighbouring districts of the Punjab and Rājputāna, and by the scarcity in Cutch. A uniform level of prices was, however, still far from being established; for in 1861, while wheat was nearly 39 seers to the rupee in the Central Provinces and 26 seers in Oudh, it was less than 19 seers in the Province of Agra and only 16 seers in Bombay. So also in 1862, when rice was 29½ seers per rupee in Bengal, it was less than 18 seers in Burma and not quite 14 seers in Madras. On the collapse of the inflation caused by the American War, prices would probably have fallen but for the great Orissa famine of 1866, which extended into Bengal proper, Bihār, and parts of Madras. Another notable famine, that of 1869, affected Western Rājputāna and parts of Northern India, and the extension of scarcity west and south produced a rise in the price of food-grains in Bombay, the Central Provinces, and Hyderābād.

Prices of 1871–80.

During 1871–5 prices were not seriously disturbed by any calamity except the Bihār famine of 1874; and although large

purchases of grain were then made by the Government, and scarcity prevailed in the adjoining Districts of the United Provinces, the disturbance of prices was not widely felt. In view, therefore, of the generally normal character of the seasons, and the fact that its middle year (1873) is that from which the great change in the relative values of gold and silver commenced, this quinquennium has been selected as the most suitable standard with which to compare the price levels of other periods. The quinquennium 1876–80 embraces the great famine of 1877–8, which affected an immense tract in Southern and Western India and extended, with diminished intensity, into the north. Great quantities of rice were sent from Bengal to the famine districts, and the price of food-grains rose to a very high level throughout India.

The export trade in wheat, which had begun in a small way after the opening of the Suez Canal in 1869, received a check during the years 1878–80; but it revived in the following year, and in 1881–2 reached an extraordinarily high level with a total of nearly 1,000,000 tons. The export trade in rice, which expanded greatly in 1872–3, was on a large scale throughout the decade under consideration, and showed greater contraction in 1874, the year of the Bihār famine, than in the Deccan famine three years later.

The period 1881–90 is noticeable for a remarkable change. Prices of 1881–90.
Speaking generally, all crops except rice were good or abundant during the years 1881–5, though there was scarcity in a portion of the Punjab in 1884, and distress in parts of Bengal and Madras in 1885. The rice crop was bad between 1883 and 1885, owing to drought and floods, but wheat was plentiful, and the average price for all grains was low. The dependence of prices on the variations of the seasons is thus, as formerly, clearly marked; but this explanation hardly suffices to account for so great a rise in prices as occurred during the last five years of the decade, for the 1889 famine in Ganjām (accompanied by distress in the Orissa States and scarcity in Bihār) was only of local importance, and prices had already reached their highest point in 1888. The export trade in food-grains was no larger than in the previous five years; and unless the harvests were generally poor, though not sufficiently so to cause noticeable scarcity, some reason for the rise other than diminished supplies must be found. There is, of course, a direct connexion between the volume of the currency and prices, but in the case of retail prices this connexion is so obscure that it cannot be traced with any certainty. Still it is

a fact that from the time this general rise of prices occurred there were heavy imports of silver, and the active circulation was increased by a large addition to the coinage.

Prices of 1891–1900.

The high prices ruling during 1886–90 were still further raised in 1891–2 by prolonged drought, causing scarcity and distress in Madras, the Bombay Deccan, Bihār, and Upper Burma. A strong Indian demand for rice was coupled with large exports, and at the same time there was an unprecedented export of wheat owing to failure of the crops in Europe, so that Indian prices reached almost to famine levels. With better seasons prices cheapened; but the lowest point reached in 1891–5 was still above the average level of the previous quinquennium and, as in that period, the importation of silver for coinage, until the closure of the mints in June, 1893, was on a large scale.

The next quinquennium (1896–1900) includes two periods of intense and widespread famine. The failure of the crops caused famine over a very large part of India in 1896–7, and the central and western regions were again desolated by the famine of 1899–1900. The effect was to raise the price of food-grains in all parts of the country to the highest levels on record. Wheat exports were reduced to insignificant proportions during the first famine, and were practically extinguished in the year following the second. But in spite of the large supplies of rice absorbed by the famine areas, a very extensive export trade in that article was maintained throughout; and in 1898–9, the year preceding the second famine, the export of rice, wheat, and other food-grains was larger than in any previous year except 1891–2, the aggregate exceeding 3,000,000 tons.

Recent retail prices, and considerations affecting them.

During the years 1901–3 the harvests have been good and prices have fallen steadily. The levels are still comparatively high, but the decline is as rapid as could be expected in view of the effects of the last two famines, and the depletion of stocks which must take years to replace. Rice, of which the exports have greatly increased during the last two years, remains extremely dear; and it has been evident for some time that the supply of this cereal, which is perhaps the most largely consumed food-stuff in India, has not kept pace with the growth of the demand. Wheat in India proper, like rice in Burma, is being grown more extensively for export, and the recent revival of the foreign demand has produced exports bearing a far larger proportion to the consumption than in the case of rice. Each of the last two famines caused a large reduction of the area under wheat, and though its cultivation

is rapidly expanding, the deficiency has not yet (1905) been made up. Of rice it may be said that present prices are as high as the famine prices of former years; but it would be incorrect to apply this statement to food-grains in general, for the price of wheat has fallen, and all the commoner grains which are the staple food of the poorest classes have cheapened remarkably between 1901 and 1904. Recent prices are, it is true, higher than the average of the first half of the forty years dealt with in the table on page 458; but allowance must be made for the gradual levelling of prices throughout Districts, Provinces, and the country at large which has followed the multiplication of the means of intercourse. The chief factor in determining the price of food-grains has been, and will continue to be, the out-turn of the crops; for as India is dependent for food on its own resources, a considerable deficiency of the supply, either actual or anticipated, must always send up prices, and it is an economic law that the increase of price is in much greater proportion than the deficiency in supply which causes it. The increase of population, and consequent pressure on the land, would operate, through the law of diminishing returns, towards a permanent increase in the price of food even though the area under cultivation expanded in the same proportion; and the demand for export has undoubtedly influenced the price of rice and wheat directly, and through them the price of the commoner food-grains. Thus, a remarkable fall in the price of food-grains in the United Provinces in the year following the severe famine of 1896–7 was assigned by the local officials to the small export demand for wheat. The steadying of prices by increased facilities of transport must, as already stated, result in raising the general level. Another general cause which would produce a higher range of prices is an inflation of the currency; and it is at least a noticeable coincidence that at the periods from which prices took an upward turn, namely, from about 1860 and again from about 1886, there was a great influx of silver and a large addition to the coinage.

The effect of the increasing price of food on the condition of the labouring classes is discussed in the section dealing with wages.

Wholesale Prices

The wholesale prices of commodities recorded in *Prices and Wages in India* relate to a few of the principal articles of import and export. There is no record, except of quite recent

date, for the markets of the interior, and the earliest quotations are for prices at Calcutta in 1843. Until 1861, moreover, the list of articles is very imperfect; and, as in the case of retail prices, it is convenient to commence with that year, which marks the beginning of a new era of commercial and industrial activity.

Variations in price between 1861 and 1903 of standard imports.

To illustrate the course of wholesale prices in tabular form, it is most convenient to substitute for the actual price of each article the percentage of its variation from the price of a given period which is reckoned at 100. The year selected is 1873, from which time the gold value of silver and of the rupee began to decline, and the price ruling in March of that year is the actual datum. The variations from this standard, calculated on the mean of the prices of January and July in each year, of certain principal imports into Calcutta are shown in the following table:—

Variations in the Wholesale Prices of Imports at Calcutta

	Grey cotton shirtings.	Cotton yarn, grey.	Cotton yarn, orange.	Copper braziers.	Iron, flat.	Average or index number.
Average. 1861–5	146	145	154	99	63	121
Average. 1866–70	125	119	111	85	69	102
Average. 1871–5	94	94	96	94	88	93
Average. 1876–80	77	83	82	86	64	79
Average. 1881–5	77	75	81	76	58	74
Average. 1886–90	79	71	81	72	62	73
Average. 1891–5	73	69	77	76	65	72
1896 .	72	73	80	82	71	76
1897 .	70	66	80	81	74	74
1898 .	64	59	67	82	74	69
1899 .	73	57	62	95	78	73
1900 .	84	66	71	110	83	83
1901 .	86	73	86	111	79	87
1902 .	80	66	78	97	70	78
1903 .	79	73	80	92	70	79

These articles, though few in number, represent in the aggregate a large share of the total import trade, and each is typical of a large class. Thus, the three forms of cotton represent all cotton manufactures, which constitute more than one-third of the total imports. Copper is an article of great importance in the domestic economy of the people; and the price of iron, of which an insignificant quantity is produced in India itself, regulates the cost of all manufactures thereof, including machinery, whether imported or made in the country. The price of imports generally, as represented by these articles,

fell by 21 per cent. between 1873 and 1903, while the fall in cotton goods was from 20 to 27 per cent., and in iron 30 per cent. It must, however, be noted that iron is subject to great variations in price, and copper is so much the subject of speculation that its price, too, is unstable. Cotton, also, is often subject to special influences; and its very high price between 1861 and 1870, or more particularly from 1863 to 1867, is due to the cotton famine caused by the American Civil War, while the effects of shortage of supply and speculation have caused an advance of price in recent years.

Prices of sugar, coal, and kerosene.

The variations of other typical imports, for which prices are not available for the whole period from 1861, are shown below:—

	1871-80.	1881-90.	1891-1900.	1901-3.
Sugar (Mauritius)	98	80	70	59
Coal (Welsh)	80	61	67	77
Kerosene (American Chester) .	...	...	101	115

The variation for kerosene is based on the price of January, 1888, and the prices are for imports at Calcutta, while the prices of sugar and coal are those for imports at Bombay. Sugar has grown to be one of the principal imports into India, and the great volume of the supplies during the last seven years, originated by the influx of beet sugar, has brought down prices. The import trade in kerosene has nearly doubled since 1888, but has recently received a check through the working of the oil-fields of Burma and Assam. Of late years, too, the development of its own coal-fields has made India almost independent of imported fuel; hence foreign coal is no longer an article of much consequence in the import trade.

Variations in price of standard exports.

The table on the following page shows the variations from the prices of March, 1873, of some of the principal exports from Calcutta and Bombay, the figures being, as before, deduced from the mean of the January and July prices in each year.

The average price or index number shows on the whole remarkable stability; but this is the result of a notable rise in rice, jute, and linseed, which counteracts a fall in the other articles, the decline being particularly heavy in the case of tea, indigo, and cotton yarn.

Rice and wheat.

The great rise in the price of rice is in agreement with the evidence of retail prices. In the case of wheat the explanation of the decline in the export price, while the retail price has risen, is that the price at Calcutta in 1873, which is taken as the datum for calculating variations of export prices, was

extremely high even for that centre, as the index for 1872 is 77, and for 1871 only 59. The wheat trade was then in its infancy, and the cost of transport often made the price at the ports double that in the wheat-growing districts from which retail prices have been taken. As railway communications developed and prices in the interior rose, freights to

Variations in the Wholesale Prices of Exports at Calcutta and Bombay

	Calcutta.							Bombay.			Average or index number.
	Rice (Ballam).	Wheat (Doodiah).	Linseed.	Jute, picked.	Jute, gunny-bags.	Tea, pekoe.	Indigo.	Cotton, raw (Broach).	Cotton yarn *.	Cotton cloth *.	
Average. 1861–5	94	81	88	107	100	...	95	123	...	...	98
Average. 1866–70	130	97	106	113	108	...	102	111	...	...	110
Average. 1871–5	118	84	103	127	103	106	132	87	90	93	104
Average. 1876–80	159	98	103	147	92	103	105	84	81	83	105
Average. 1881–5	124	83	93	126	103	75	110	87	76	80	96
Average. 1886–90	137	83	104	164	111	65	86	89	75	77	99
Average. 1891–5	168	89	119	190	108	61	98	83	70	77	106
1896 .	168	102	96	191	103	60	105	85	75	77	106
1897 .	218	141	96	194	97	52	84	77	73	77	111
1898 .	184	95	91	156	82	57	76	68	61	76	95
1899 .	146	81	99	170	88	42	57	59	52	70	86
1900 .	155	111	142	197	108	46	74	85	61	73	105
1901 .	184	106	156	193	104	33	65	84	67	87	108
1902 .	195	95	150	186	94	40	65	83	66	84	106
1903 .	163	87	116	199	97	50	61	83	67	81	100

* The percentages here are on the price of January, 1874.

the ports were greatly reduced, and thus a fair stability of prices was maintained. Another noticeable feature is the failure of the export price to respond as fully as the retail figures to the deficiency of supplies caused by the drought of 1899, which was practically as serious as that caused by the great drought three years previously. The reason for this would seem to be that the later crop failure was more in Central and Western India than in the districts of Northern India, from which supplies for export are so largely drawn; and the fact that the export of wheat in 1900–1 practically ceased must be partly attributed to the lower prices ruling in Europe. The dependence on foreign prices of crops grown for export is also apparent in the case of rice, for the rise at Rangoon in

recent years is not nearly so great as at Calcutta, and the variations, which are often the result of speculation, are quite unconnected. Thus while the index numbers at Calcutta during the three years 1901–3 were 184, 195, and 163, at Rangoon they were 122, 118, and 151.

Linseed, jute, tea, indigo, and cotton.

Dealing briefly with the other articles given in the table, the recent rise in the price of linseed, followed by an abrupt fall due to greatly increased supplies, represents the course of prices for this article in European markets. Jute, like all monopolies for which there is a great demand, has risen much in price, while gunny-bags have recently shown a downward tendency. The great fall in the price of tea is due to production in excess of the demand; and in the case of indigo to the loss of its monopoly through the discovery and largely increasing manufacture of a chemical substitute. The trade in cotton and its price have been subject to wide fluctuations owing to variations in the supply and demand. In the third year of the American War the index rose as high as 229, and in 1899, when the crop was a failure and American cotton was extremely cheap, it fell to 59. The latest rise, following on the gigantic speculation in American cotton, is not shown in the table; but the price of January, 1904, gives an index of 103, and during the same month the figures for yarn and cloth are 74 and 85 respectively. The increase under cotton manufactures has not been proportionate to this rise in the price of the raw material, and the profits of the Indian spinning mills were for a time greatly reduced by the low price of yarn.

Hides and skins.

The prices of cow-hides at Calcutta and of skins at Madras show the following variations, the standard figure (100) being here the price in 1879:—

	1871-80.	1881-90.	1891-1900.	1901-3.
Hides, raw . .	93	121	166	193
Skins, tanned	105	125	139	138

The prices of hides and skins are influenced by the seasons, as a serious drought leads to heavy mortality of stock. Up to 1879 the quality of hides for which prices were quoted was rather inferior, so that the rise shown by the index is exaggerated. During the last three years hide prices have been steadily rising.

General conditions affecting prices.

The question remains whether any conclusions can be drawn as to the operation of general causes which have tended to raise or depress prices. It has been noticed in

regard to retail prices that from about 1886 there was a rise which was not attributable to bad harvests, and the same effect may be discerned in the prices of imports and exports from 1887. The import prices of the commodities mentioned in the tables on pages 462-3 are of course regulated by gold prices, or by the relation of gold to silver prices which is expressed by exchange. So also the export prices, especially of those articles principally produced for export, follow gold prices when exported to countries with a gold standard; and it should be noted that in 1873, the year taken as the standard level, gold prices were excessively high, and that they then declined pretty steadily until 1887, when a temporary rise set in. But the peculiar nature of the chief products of India has also to be taken into account; for some, like jute, indigo, rice, and tea, are either monopolies or have a preponderating influence on world prices, while others, like wheat and cotton (though both these have recently come to the front in an unusual degree), are often of very secondary importance. Further matters to be considered are the rapid growth of trade, the lowering of inland and ocean freights, and the gradual development of a backward country. Still, with all these reservations, the conclusion seems justified that the contraction in the volume of the currency which must have resulted from the suspension of rupee coinage during the three years following the closure of the mints, and the very limited re-coinage operations of the next three years, caused a sensible reduction in the general level of prices during the years 1898 and 1899. The remarkable cheapening of both the retail and wholesale prices of food-grains in the year immediately following the great famine of 1896-7 also gives support to this view.

Wages

The official returns.

The official District returns of wages date only from 1873. The wages reported are of unskilled and skilled labour, the types of the former being the agricultural labourer and the domestic servant (as represented by the syce or horse-keeper), and of the latter the common artisan, whether mason, carpenter, or blacksmith[1]. General tendencies are broadly delineated in

[1] As regards distribution of employment, the following passage from Vol. I, chap. ix, which summarizes the 'occupation' figures of the 1901 Census, may be conveniently repeated here: 'Nearly two-thirds of the population in 1901 relied on some form of agriculture as their principal means of subsistence: 52 per cent. were either landlords or tenants, 12 per

the figures; but for exact comparisons they are untrustworthy as, owing to the absence of instructions in regard to the precise nature of the information to be given in the returns, and the widely differing systems of engaging and remunerating labour throughout India, it is impossible that uniformity of method should have been observed in different Districts and Provinces. In some cases, too, it is evident that apparent changes in the same District are due to different methods of estimating wages.

As regards agricultural labour, the system of payment in kind is still widely prevalent. Occasionally the labourer may be a bondservant, for traces of the old system of agricultural bondage still remain, and in this case he gets a regular subsistence with small perquisites. Ordinarily a farm labourer is fed, or gets a certain fixed ration of grain, in return for regular service. He receives perquisites in the shape of an occasional piece of cloth, an advance or small gift to meet marriage expenses, and sometimes a small cash wage, and he may be housed by his employer. Casual hiring may be for a particular season or operation, as for the harvest, or for a daily wage; but in most rural tracts the remuneration is wholly or partly in grain, or a cash wage is supplemented by one or two free meals. In some cases the remuneration given for certain agricultural operations is a percentage of the crop. The regularity of employment also differs greatly, and in several Districts labourers are regularly without work for three or four months, so that their average earnings must be calculated on what they receive during eight or nine months of the year. In many parts, also,

Payment of wages in kind.

cent. were field labourers, and about 1 per cent. were growers of special products or engaged in estate management, &c. In addition to these, about 2½ per cent., who mentioned some other form of employment as the chief source of their livelihood, were also partially agriculturists; and another 6 per cent., who were shown as "general labourers," were doubtless in the main supported by work in the fields. About 15 per cent. of the population are maintained by the preparation and supply of material substances; and of these more than a third find a living by the provision of food and drink, and a quarter by working and dealing in textile fabrics and dress. Domestic and sanitary services provide a livelihood for only 4 per cent. of the population; and commerce, the learned and artistic professions, and service under Government for barely half as many each. In cities, as might be expected, the functional distribution is very different from that in the country as a whole: the proportion of persons dependent on agriculture falls from two-thirds to one-twelfth; the number engaged on the preparation and supply of material substances rises from one-seventh to two-fifths; one-eighth derive a livelihood from commerce, and nearly as many from personal and domestic services; one-eleventh from unskilled labour, and one-fourteenth from Government service.'

landless labourers are not numerous, and those who work for hire supplement by wages the income derived from a small plot of land. Village artisans and domestic servants are also commonly paid in kind, and the former often possess land. There appears to be a desire on the part of employers to substitute cash for grain wages as the price of grain rises; but, speaking generally, cash wages are still commonly paid only in the vicinity of towns or industrial villages, and by large employers of industrial labour.

Difficulties in using the wages returns.

The official returns do not, as a rule, discriminate between rural and urban areas, nor, if they give the cash equivalent of wages in kind, do they state how the conversion is made. The following changes in the record have, however, been detected: namely, from gross wages including food to net cash wages; from daily wages for casual hire, which are multiplied by 30 and represented as monthly wages, to the rate for monthly hire; from agricultural rates to town rates; from the average of several small town or village rates to a city rate; and from single to combined wages for a man and his wife working together. Confusion is also caused by combining under one head the wages of the mason, the carpenter, and the blacksmith, for their remuneration is far from equal; and in some cases it would seem that the word 'common' has been read as applying only to the mason, and that wages have been returned for the carpenter or the blacksmith, and more particularly for the latter, at a scale far above the average of the trade. In these circumstances it is impossible to state with precision the percentage of variation in wages during the last thirty years. Inquiries are now being made as to the possibility of a more accurate record.

Variations of wages in different localities and in different circumstances.

Another difficulty in dealing with wages, apart from the want of uniformity in the reports, is that an average wage for India generally, or for a single Province, has little meaning, as wages vary greatly according to locality. Thus, in Bengal wages are high in the east, where the peasantry are prosperous and considerable affluence prevails; they reach a lower level in the central Districts, except where the prevalence of malarial fever has checked the growth of population[1]; and in the congested Districts of Bihār they sink very low. Bengal is not peculiar in this respect, for a low and non-progressive scale of wages will be found in all parts of India where agriculture is the chief occupation and the density of the population causes pressure on the means of subsistence. But wherever a demand for

[1] In Burdwān, for instance, wages are very high.

labour has been created by large undertakings, such as railways or canals, wages have risen. The establishment of mills and factories in many towns throughout the country, and the development of mining and other industries, have exercised a similar influence, illustrating the economic theory that wages depend mainly on the demand and supply of labour. It follows that high prices do not always involve high wages. In fact, the most direct connexion between prices and wages in India, and that which takes effect most rapidly, is the reduction of wages in times of scarcity, when food is also inordinately dear. The failure of the crops destroys a large portion of the fund used in paying wages, and the numbers seeking employment are greatly enhanced, so that those who find it often obtain in return the barest subsistence. When, however, a rise in the price of agricultural produce is due to a larger demand, and extra profits are thus obtained by the cultivator or landowner, wages may and do rise. The great boom in cotton during the American Civil War, and the profitable cultivation of jute in Eastern Bengal, are examples of this. As to payments in kind, in so far as the labourer receives the same quantity of grain, his real wages are unaffected by a rise in its price, unless he can save a portion and thus make a profit by selling it; but it must be borne in mind that, in the case of casual labour, remuneration in kind, like a cash wage, is affected by competition. In the Central Provinces, which have suffered during the last decade from two great famines and several bad seasons, there is a tendency for wages paid in grain to decrease, either in actual amount or by change from superior to inferior kinds of grain.

Although for purposes of accurate comparison the statistical data are seriously defective, they will serve for a rough indication of the course of wages. From a comparison of the Provincial averages which are summarized in the Appendix (pp. 472–4), it would appear that between 1873 and 1903 the wages of the three classes of labour—namely, the agricultural worker, the domestic servant (as represented by the syce), and the artisan—have all risen far more in Bengal, Assam, and the Punjab than in other parts of India, the indicated rates of increase being, for agricultural labour, 39 per cent. in Bengal, 41 per cent. in Assam, and 49 per cent. in the Punjab; and for artisan labour 48 per cent. in Bengal, 65 per cent. in Assam, and 50 per cent. in the Punjab. This establishes a relation between wages and the normal cost of living, for the staple food of Bengal and Assam is rice, the price of which has risen more than that of

any other food-grain, and the price of all food-grains has also risen remarkably in the Punjab[1]. In Burma, where wages are very much higher than in India, there has been little advance. Similar stagnation is characteristic of Bombay, which started with a high level, while in Oudh, where wages have always been low, they appear to have fallen. Except in the case of agricultural labour, Madras shows a greater rise than the Central Provinces, the reported range for the three classes being an increase of from 6 to 13 per cent. in the Central Provinces, and from 10 to 15 per cent. in Madras. In every Province except Madras the smallest rise, or the greatest fall, is in the wages of horse-keepers, who are not, however, a very representative class. The common belief that the wages of skilled labour have advanced more than those of unskilled work is not altogether corroborated by the District returns for artisan labour, for this result appears in only three Provinces—Bengal, Assam, and Madras. The evidence of various records of wages in industrial establishments is also conflicting on this point, and therefore inconclusive, unless reservations are made as to particular kinds of employment and degrees of skill. A factor to be reckoned with is the very low standard of comfort prevailing among the working classes, and their unwillingness to accept better circumstances when coupled with conditions that are not wholly congenial. This it is which explains the general difficulty of obtaining a sufficient supply of labour for tea gardens, collieries, or factories. Prejudices are, however, disappearing, and of late years a great improvement has taken place in the mobility of labour. Besides the emigration to foreign countries and the tea districts which is regulated by law, there are large and constantly increasing migrations of labourers, by sea and land, to other countries and Provinces, or from District to District within the same Province[2]. These periodical movements are largely for the performance of agricultural work, but are none the less beneficial in relieving the pressure in densely populated agricultural districts, where the remuneration of the labourer is often but a scanty subsistence. As this process proceeds, and the supply of labour for industrial employments adjusts itself to the growing demand caused by the development of the country, the condition

[1] Throughout the greater part of India the purchase of food is by far the chief necessary expense which the labourer has to incur. His hut and his scanty clothing cost him very little, and sticks and cow-dung supply his demand for fuel.

[2] For information as to migration see Vol. I, chap. ix, Population.

of the Indian labouring classes must constantly tend to improve.

Evidence of progress already made in material prosperity is furnished by the increased consumption of salt (5 seers per head in 1903 against 3·6 in 1871), by the large development of the excise revenue during this period (see Vol. IV, chap. viii), and by the great increase in savings banks deposits (chap. viii of the present volume). Reference may also be made to chap. xxiv of the India Office *Report on the Moral and Material Progress of India*, 1901–2, which contains an abstract, prepared from memoranda compiled by the Local Governments, of the economic condition of the people in the principal Provinces during the preceding decade. Marked though that decade was by very severe famines and by the visitation of plague, the results generally show satisfactory progress, save in the Central Provinces and in the Bombay Presidency proper, which suffered most severely from famine during this period. Conclusion.

Bibliography

Rents

C. D. Field.—*Landholding and the Relation of Landlord and Tenant in various Countries*. (Calcutta, 1885.)

R. F. Rampini and M. Finucane.—*The Bengal Tenancy Act VIII of* 1885, *with Notes and Rulings, &c.* (Calcutta, 1886.)

Also the Tenancy Acts of the various Provinces, and most of the works quoted at the end of the chapter on Land Revenue (Vol. IV, chap. vii).

Prices and Wages

The annual publication of the Director-General of Statistics, entitled *Prices and Wages in India*.

F. Chambers.—*Variations of the Prices of Staple Food-grains in the Bombay Presidency*. (Bombay, 1886.)

J. E. O'Conor.—*Indian Price and Wage Levels*, 1861 *to* 1873 *and* 1874 *to* 1887. (Calcutta, 1887.)

J. A. Robertson.—*Variations in Indian Price Levels since* 1861, *expressed in Index Numbers*. (Calcutta, 1905.)

Chapter xxiv of the *Report on the Moral and Material Progress of India*, 1901–2 (India Office).

APPENDIX

Average Monthly Wage, in Rupees and Decimals of a Rupee, of—

TABLE I. An able-bodied Agricultural Labourer

Province.	Averages.							Percentage of rise between 1873 and 1903.*
	1873-5.	1876-80.	1881-5.	1886-90.	1891-5.	1896-1900.	1901-3.	
Bengal	5·0 to 5·3	5·2 to 5·7	5·5 to 6·0	6·0 to 6·6	5·8 to 6·5	6·3 to 7·3	6·5 to 7·1	39·3
Assam	6·5 to 6·8	7·7 to 8·5	7·0 to 7·9	6·5 to 7·2	7·1 to 8·2	8·0 to 9·4	8·0 to 10·7	40·6
United Provinces:								
Agra	4·1	4·2	3·8 to 4·1	4·3 to 4·4	4·4 to 4·8	3·9 to 4·4	4·1 to 4·7	22·7
Oudh	3·2 to 3·4	2·9 to 3·3	2·8 to 3·1	3·4	3·2 to 3·7	2·8 to 3·5	3·0 to 3·7	– 2·0 †
Punjab and Frontier Province	5·3	5·8	6·2	6·6	6·7	7·5	8·0 to 8·1	49·4
Madras	4·0	4·3	4·3	4·3 to 4·6	4·1	4·2	4·3	9·8
Bombay	7·5 to 7·8	7·1 to 7·6	7·4 to 8·1	7·4 to 7·8	7·6 to 8·0	7·1 to 7·5	7·6	11·6
Central Provinces . . .	3·9	4·3	4·3 to 4·4	3·8 to 4·1	4·2 to 4·6	4·1	4·4	12·5
Burma	16·6 to 17·3	17·2 to 19·0	14·3 to 15·1	15·3 to 16·5	14·0 to 14·7	14·5 to 15·2	14·1 to 15·1	8·5
Average for all India . .	6·2 to 6·4	6·5 to 7·0	6·2 to 6·6	6·4 to 6·8	6·3 to 6·8	6·5 to 7·0	6·7 to 7·3	20·6

* Whereas the preceding columns give averages, this column represents the actual difference between the first year (1873) and the last year (1903) of the series.
† Decrease.

TABLE II. A SYCE OR HORSE-KEEPER

PROVINCE.	AVERAGES.							Percentage of rise between 1873 and 1903*.
	1873-5.	1876-80.	1881-5.	1886-90.	1891-5.	1896-1900.	1901-3.	
Bengal	4·9 to 5·2	4·8 to 5·4	5·2 to 5·8	5·2 to 6·0	5·4 to 6·3	5·9 to 6·6	6·0 to 6·8	32·0
Assam	6·9 to 7·3	7·6 to 8·4	7·5 to 8·6	7·2 to 8·4	7·9 to 9·7	8·1 to 10·2	8·0 to 9·7	30·2
United Provinces:								
Agra	4·5	4·4	4·4 to 4·7	4·7	4·7 to 5·2	4·5 to 5·1	4·6 to 5·2	15·6
Oudh	4·4 to 4·5	4·3 to 4·6	4·2 to 4·3	4·2	4·4	4·0	4·0	−9·3 †
Punjab and Frontier Province	5·5	6·0	6·4	6·3	6·2	6·5	7·0 to 7·1	22·5
Madras	5·8	5·8	5·6	5·8 to 6·0	6·2	6·4	6·3	11·9
Bombay	8·5	7·8 to 8·2	8·1 to 8·9	8·3 to 8·7	8·4 to 8·9	7·9 to 8·4	8·7	1·9
Central Provinces	5·6	5·6	5·7 to 5·8	5·2 to 5·7	5·6 to 6·4	6·0	5·6	6·4
Burma	11·3 to 13·0	11·7 to 12·9	12·4 to 12·9	13·0 to 13·5	13·7 to 14·2	13·1 to 14·5	12·1 to 13·4	−5·6 †
Average for all India	6·4 to 6·7	6·4 to 6·8	6·6 to 7·0	6·6 to 7·1	6·9 to 7·5	6·9 to 7·5	6·9 to 7·4	9·5

* Whereas the preceding columns give averages, this column represents the actual difference between the first year (1873) and the last year (1903) of the series.

† Decrease.

TABLE III. A Common Mason, Carpenter, or Blacksmith

Province.	Averages.							Percentage of rise between 1873 and 1903*.
	1873-5.	1876-80.	1881-5.	1886-90.	1891-5.	1896-1900.	1901-3.	
Bengal	7·6 to 11·6	7·7 to 11·3	8·0 to 12·0	8·6 to 12·8	9·0 to 14·1	10·2 to 14·6	11·4 to 15·3	47·6
Assam	12·0 to 16·9	12·8 to 17·2	14·1 to 26·5	13·9 to 32·5	14·1 to 35·0	13·3 to 34·6	13·5 to 32·7	64·9
United Provinces:								
Agra	9·8	8·9	8·2 to 9·3	8·4 to 10·6	9·7 to 10·8	8·8 to 9·6	8·9 to 10·3	1·6
Oudh	7·1	7·4 to 7·9	7·6 to 8·1	7·5 to 10·1	8·7 to 10·4	6·9 to 7·4	6·8 to 7·4	− 2·6 †
Punjab and Frontier Province	12·7	14·1	14·8	15·7 to 16·1	16·4	18·5	18·5 to 20·2	50·1
Madras	12·7	13·0	13·7	13·3 to 13·9	13·6 to 15·2	13·6 to 15·6	13·5 to 15·4	15·5
Bombay	19·1 to 23·8	19·3 to 23·3	19·9 to 24·2	20·4 to 25·0	19·2 to 24·7	18·7 to 25·5	17·7 to 22·8	− 3·3 †
Central Provinces	12·4	13·0 to 14·4	14·4 to 15·3	12·0 to 13·9	12·2 to 15·5	11·8 to 12·8	12·9 to 13·7	12·6
Burma	25·2 to 31·3	27·5 to 34·5	29·7 to 32·5	28·8 to 30·4	24·3 to 27·6	26·6 to 31·1	27·3 to 32·6	6·9
Average for all India	13·2 to 15·4	13·8 to 16·1	14·5 to 17·4	14·3 to 18·3	14·1 to 18·8	14·3 to 18·9	14·5 to 18·9	19·4

* Whereas the preceding columns give averages, this column represents the actual difference between the first year (1873) and the last year (1903) of the series.
† Decrease.

CHAPTER X

FAMINE

I. The Cause of Famine

FROM the days of the Buddhist pilgrims from China to the latest Moral and Material Progress Report, famine lies broad written across the pages of Indian history. The accounts of early famines are indeed most meagre. In the chronicles of courts, which cared little for the people, social calamities found but scant record. A few lurid descriptions have come down to us—man feeding on man and even slaying him for food, the violation of all natural ties[1], conspicuous acts of unavailing charity, depopulation, and the loss of revenue; but of famine history in its wider range there is no trace. We only know that famines were very frequent under Native rule, and frightful when they came[2]. We know also that they have been frequent since the British came to India.

Famines periodic.

This frequency of famine is easily explained. Famine is a disease of all agricultural countries. India is, and always has been, mainly agricultural, and agricultural under conditions peculiarly exposed to famine. The soil is parcelled out in minute farms. The farmers have no capital and depend on unorganized local credit, which shrinks when harvests fail.

Dependence of India on agriculture.

[1] 'The flesh of a son was preferred to his love,' says one chronicler.

[2] 'In 1630,' says Sir W. W. Hunter, 'a calamity fell upon Gujarāt which enables us to realize the terrible meaning of the word famine in India under Native rule. Whole cities and districts were left bare of inhabitants. In 1631 a Dutch merchant reported that only eleven of the 260 families at Swally survived. He found the road thence to Surat covered with bodies decaying "on the highway where they died, there being no one to bury them." In Surat, that great and crowded city, he "could hardly see any living persons"; but the corpses "at the corner of the streets lie twenty together, nobody burying them." Thirty thousand had perished in the town alone. Pestilence followed famine. . . . "This, that was in a manner the garden of the world, is turned into a wilderness." The Dutchman estimated that it would take three years before the trade could revive at Surat. Indeed one striking contrast between Native and British rule was the slowness of recovery from famine in the Mughal Empire.'—*History of British India*, vol. ii, p. 59.

Off the land, but dependent on it, are millions of agricultural labourers, the vast majority of whom have only casual employment and are thrown out of work when harvests fail. Thus, the masses of the Indian people depend upon the harvests, and these depend upon a periodic, but by no means regular, rainfall.

The two monsoons.

The two rain-bearing currents are (1) the south-west monsoon, commonly called *the* monsoon or *the* rains, and (2) the so-called north-east monsoon, the period of which is marked in North-Western India by what are commonly called 'the winter rains.' The agricultural year commences with the former, which is the more important of the two.

South-west monsoon and the autumn harvest.

For a month or two before the rains the land has rest over the greater part of India. The heat is intense, the soil is baked, ploughing is impossible, and the people sit in their villages literally gasping for rain. The monsoon bursts in June, and dies away at the end of September or beginning of October. After the first heavy shower, ploughing begins, and the autumn harvest (*kharīf*), which provides the year's food for the poorer classes, viz. millets and rice, is sown. It occupies the ground for from two to four months, during which period the distribution of the rainfall is even more important agriculturally than its amount. A long break in the rains and hot dry winds cause serious loss; excessive rain produces floods; and continuous rain interrupts work in the fields. On fine days the people are very busy: the autumn harvest requires two or three weedings, and the land reserved for the spring harvest is ploughed many times. Weeding, ploughing, and harvesting employ millions of labourers.

North-east monsoon and the spring harvest.

In October or November, the spring harvest (*rabi*) is sown. Wheat, barley, pulses, and the more valuable non-food crops[1] are grown in the north; the larger millets predominate in the south of India. The so-called north-east monsoon breaks on the east coast in November or December[2], while the winter rains fall in the north from Christmas on to February. The spring are less precarious than the autumn crops. But heavy or prolonged rain, accompanied by east winds, causes rust in the wheat and barley; and premature hot west winds shrivel up the swelling grain. Harvesting begins in March and April,

[1] Opium, tobacco, oilseeds, &c.

[2] As will be seen from the Meteorology chapter (Vol. I, chap. iii), the rainfall which is so important in Eastern Madras in November and December is really due to the retreat of the south-west monsoon current. The north-east monsoon proper is not established till the end of December.

and again employs millions of labourers. Intermediate crops, such as sugar-cane and the late cotton, also employ large numbers.

Thus, any failure of the rains involves some failure of crops, thereby reducing the supply of food and stopping the demand for labour. But not every failure of the rains causes famine. The people are not generally dependent on the out-turn of a single harvest. The railways have put the whole food-supply of the country into circulation, and what is lost in one part of the country is made good from another. The cultivators have some resources and credit. The spring harvest may be good although the autumn harvest has failed. The agricultural labourers are safe so long as there is a demand for labour, and there are various degrees of crop failure with varying effect upon the labour market. A widespread failure of either harvest will cause distress, especially to the agricultural labourers; but it depends on several conditions, such as the character of preceding harvests, and the degree in which agricultural operations are affected, whether the distress will amount to famine. Cause of famine.

II. The Famine Problem, and Modern Relief

Formerly war, rapine, and misrule were direct causes of famine. These have disappeared and in the process a new problem has arisen. Peace has multiplied the people. The custom of the country favours early marriage, while the general security has removed the old checks on population. And as those who have least hope in the world usually bring most children into it, the increase of population has been great among the poorer cultivators and the agricultural labourers. The modern outlets, emigration and industrial development, afford as yet little relief. Large tracts in India still await population, but the inhabitants of congested districts will not move to them, partly from habit, but largely from regard to caste and language. Industries are growing up, but as yet they draw only small numbers off the land, occupation being still prescribed by inheritance and tradition. Pressure, therefore, increases where it is already greatest. Holdings already small are subdivided, or sublet at competition rents, while the supply of agricultural labour outruns the demand for it, and so keeps agricultural wages low. Removal of former checks on population.

This is the great famine problem. It is not in the power of man to prevent drought in India, or, so long as the country is mainly agricultural, to prevent drought from causing famine: Statement of the famine problem.

all he can do is to restrict and mitigate the resultant suffering. Modern famine policy is thus a struggle against nature. As such it has two objects, the one remedial, the other protective. It seeks to relieve distress when droughts come; and it seeks in many ways to fortify the people against drought[1].

Modern relief policy.

Under Native rule there was little thought for, and no effective means of, remedial action. Occasionally a large relief work was started and spasmodic attempts were made to send food to famine-stricken areas. But primitive transport could not enter fodderless and roadless country, and so broke down where most required. The people wandered and died in thousands, the country was desolated and the revenue was not collected. Conditions scarcely changed in the early days of the East India Company, but by degrees a scheme of systematic relief grew up. The modern view of the responsibility of the state was not reached, however, until India had passed under the Crown. In 1868 the famous order was issued[2] that 'every District officer would be held personally responsible that no deaths occurred from starvation which could have been avoided by any exertion or arrangement on his part or that of his subordinates.' And, after some experience of the demoralizing influence of indiscriminate state charity, relief policy assumed its final shape in the declaration made by the Secretary of State in 1877:—

> 'The object of saving life is undoubtedly paramount to all other considerations. But it is essential that in pursuing this end your officers should sedulously guard against the danger of inducing the population to rely upon Government aid rather than upon their own industry and thrift. In the interests of the distressed population itself, as well as of the tax-payers generally, you are bound to adopt precautions against indolence or imposition, similar, so far as the circumstances of India will permit, to those with which in this country it has always been found necessary to protect the distribution of public relief from abuse.'

This policy has been accepted by three Famine Commissions —in 1880, 1898, and 1901. It resolves relief administration into the anxious problem of how to hit a happy mean, how to steer between the rock of distress and the whirlpool of demoralization.

Practical difficulties.

The carrying out of this policy is beset with many and great practical difficulties. India has no poor law. In ordinary times private charity supports the poor; in times of famine

[1] The protective aspect of the problem is discussed in the fourth section of this chapter.

[2] By Sir William Muir, the Lieutenant-Governor of what is now the Province of Agra.

this charity dries up, and the recipients of it are thrown upon the state together with large numbers of the agricultural population. In the nineteenth century the largest area simultaneously affected by drought was 475,000 square miles (in 1900), and the largest population so affected was 69,500,000 (in 1897); the largest number relieved at any one time was 6,500,000. Over such large areas, and for such large numbers, the Indian Government may in any year be called to improvise a system of relief without disturbing ordinary public business. Nor do the difficulties end with the numbers. The peoples of India are infinitely various in habits, creed, custom, caste, and language. The language of one part of a Province may not be understood in another part of it. Thousands would die sooner than resort to relief camps or touch food which they thought was unclean, either in itself or by reason of the agency employed in its preparation. One caste will not feed with another. The shy folk of the hills will not work with the people of the plains. Skilled weavers will not go to ordinary relief works for fear of losing their delicacy of touch. And for dealing with these sensitive, suspicious masses, the Government has to organize and control vast temporary establishments, which are generally untrained and have a low standard of intelligence and integrity. The difficulties would be insuperable if the people were less orderly, or less amenable to discipline. But discipline can be enforced, and corruption and demoralization can be kept down, only if relief is closely supervised by European officers, and it is very hard to find the men.

A modern plan of campaign.

These difficulties have, however, in great measure been overcome. Under the stern but efficient teaching of experience, an elaborate system of relief has now been worked out. Philanthropists may still mourn that complete success has not been attained; those who are acquainted with Indian conditions will perhaps rather marvel at the progress already made. It may fairly be said that, in spite of inevitable defects, a modern Indian famine campaign is one of the most remarkable achievements in history of scientific administration.

Standing preparations.

Standing preparations are made on a large scale in ordinary times. The Government is kept informed daily of meteorological conditions, weekly of crops and prices, and monthly of birth and death rates. Programmes of suitable relief works are revised annually in every District. The country is mapped out into relief-circles of convenient size. Reserves of tools and plant are stocked, and lists of persons suitable on emergency

for famine establishments are annually drawn up. In short, every effort is made so to arrange matters in advance that a telegram from head-quarters can mobilize relief.

Danger signals.

When the rains fail preliminary inquiries are started; a forecast of the probable crop failure is made; and a careful look-out is kept for the regular danger signals of approaching distress. Prices begin to rise and the people become uneasy. Aimless wandering in search of work takes the place of the seasonal movement of labour which attends a normal harvest. Private charity in the villages contracts, and the habitual paupers who depend upon it drift to the towns. Petty crimes against property increase; credit becomes more difficult; and grain-dealers make large purchases. During this period of tension the local officers look to their programmes of relief and prepare for action.

Preliminary action.

As the uneasiness is intensified, the Government makes the necessary financial arrangements and declares its general policy. At this stage great importance attaches to 'moral strategy.' In an Eastern country hope turns quickly to despair, and despair shades off insensibly into a dull resignation. Accordingly, meetings are held; policy is explained; non-official gentlemen are encouraged to be active, especially in undertaking local improvements which will employ labour; committees are appointed to stimulate and organize private charity; village inspection begins, and preliminary lists of helpless persons who may require gratuitous relief are made. All this gives confidence to the people, who are further encouraged by liberal advances of money for wells and work in the field, and by detailed inquiries as to crop failure which are undertaken at this stage with a view to suspension of revenue. If the number of paupers in the town is great, poorhouses[1] are opened.

The period of test.

Test works[2] are also started. This is an anxious stage. If the tests are too lenient the state may be led on to unnecessary expenditure; if they are too strict the situation may not be grasped. The condition of those who seek employment on the test works is closely watched, and a look-out is kept by village inspection on the condition of those who stay in their villages. At this, as at every stage, the death-rates are scrutinized.

[1] A poorhouse is a temporary structure, run up in a few days, where paupers are sheltered and given cooked food under conditions of decency and discipline.

[2] A test work is an ordinary work employing unskilled labour, usually earth-work. The conditions are strict but not unduly repellent, the object being to ascertain whether the people really need relief.

When the test works, or village inspection, disclose real distress, relief works are opened, the village inspecting staff is increased, the lists of persons entitled to gratuitous relief are revised, and the distribution of gratuitous relief begins. By the end of December in a famine year the numbers on relief are as a rule large. The gathering of an intermediate crop like sugar-cane may reduce them slightly, but generally they continue to rise till the following March. The great spring festival, the Holī, the reaping of the spring harvest (if there be one), and the ripening of the *mahuā*, or of the mango, crops usually draw off many relief workers for a time: these mostly return, however, by the end of April. In May distress reaches its maximum, and cholera generally breaks out. The period of general relief.

An outbreak of cholera is the supreme test of organization. In the Pānch Mahāls District of Gujarāt, in 1900, cholera broke out suddenly with extraordinary virulence. In three days the dead numbered thousands and the people fled panic-stricken all over the country, spreading the disease. The native staff and camp attendants deserted in large numbers, and the European officers were left to collect with their own hands and burn some hundreds of corpses. Famine history is lit up by acts of self-sacrifice, and devotion even to death, but it records no nobler work than that performed by the European officers on this occasion. Cholera.

The power of efficient organization was displayed in the management of a cholera outbreak in Bundelkhand in 1897. The Lieutenant-Governor was prepared, and the relieving staff and the people had been schooled by two years' experience of famine. The country had been divided in advance into circles in which small works were mapped out. On the first outbreak of cholera the people on the large relief works were split up into parties of about 500, and marched with full staff and equipment to the circles in which their villages were. Here they found small works ready for them; the wells had been disinfected; work was commenced at once; there was no panic; and the pestilence was stayed.

Policy changes somewhat with the advent of the rains. Relief works are generally closed, and there is an extension of local gratuitous relief. In the interests of the country at large, and of the people themselves, it is important that ordinary agricultural conditions should be restored with the least delay, and that as large an area as possible should be sown. For this purpose, the people are moved from the large works to small works near their villages at the end of May, and liberal Rains policy; the beginning of the end.

advances are made to agriculturists for the purchase of plough cattle and seed. When the rains break relief-workers return to their fields in crowds; if any stay on the works they are encouraged to return to their villages as soon as the demand for labour springs up. A few relief works are kept open, in case of need, and every one who cannot work and requires relief receives it gratuitously. The state supports, where necessary, the weakly members of a family, and the able-bodied are able to support themselves.

Closure of relief.

When the earliest of the principal autumn crops is ripe, the few remaining relief works are closed gradually, and gratuitous relief is discontinued, the recipients being given a valedictory dole, and by the middle of October famine is ordinarily at an end. Quinine is distributed in large quantities during September and October, in anticipation of fever, which generally prevails in the autumn.

Charitable relief funds.

The strictness of Government relief, which must inevitably be confined to the provision of necessaries, is softened and supplemented by private relief funds, to which it may be said that almost the whole world subscribes. These subscriptions are devoted to four principal objects, of which the last absorbs about two-thirds of the whole: (1) providing small comforts of food or clothing to the aged, infirm, sick, children, and others in need of them; (2) helping orphans; (3) relieving the respectable poor in ways acceptable to them; and (4) giving a fresh start in life to those who have lost everything in the struggle. Thousands of desolate homes have been restored by this splendid charity.

The Indian people's famine trust.

In 1900 the Mahārājā of Jaipur presented 16 lakhs of Government securities to be held in trust for the relief of the needy in times of famine. This trust has now (1905) 30 lakhs in Government securities, the greater part of which has been contributed by the founder and his family. It is vested in a body of trustees selected from all parts of India, and the income will be devoted, in times of famine, to objects similar to those of the charitable relief fund.

Improved communications, and greater knowledge, the main

The greatest administrative achievement of the last twenty years has been the extension of communications. Railways have revolutionized relief. The final horror of famine, an absolute dearth of food, is now unknown. Private trade pours in food wherever it is required[1]. The telegraph has made con-

[1] This result seems all the more remarkable when one considers the state of Europe fifty years ago. In the great famine of 1848 in rural Germany 'which decimated the people,' we read that 'usury was frightful and

trol efficient; and as the administration has been freed from the primary necessity of finding food, it has been able to grapple successfully with other difficulties, supported, as it now is, by a system of agricultural intelligence, and increased knowledge of the social conditions of India [1].

Causes of efficiency in famine relief.

Under these influences the relief system has become increasingly elastic. Relief works are organized with due regard to the feelings of the people. Those who cannot work are relieved, as a rule, in their villages, and special consideration is shown to the respectable poor. The habitual beggars, the waifs and strays of society, are sheltered, clothed, and fed in poorhouses. Children are protected from the rapacity of their parents by being fed in kitchens, a precaution proved by sad experience to be necessary, and milk is given to infants whose mothers cannot nurse them. Weakly persons are specially treated. Deserted children are separately cared for, and returned to their relatives or co-religionists, if they will take them, at the close of the famine. An elaborate scheme for making relief acceptable to forest and hill tribes has been worked out; and weavers and artisans, who formerly suffered on ordinary relief works, are now, as far as possible, relieved in their own trades. Non-official aid and advice are enlisted on the side of Government. In a word, no effort is spared to prevent the loosening of social and moral ties, which is the melancholy accompaniment of an economic cataclysm like famine.

Present elasticity in the relief system.

In the following section a sketch will be given of the efforts and experience, the failures and the successes, which have gradually evolved this result.

III. *History of Chief Famines, and of Famine Relief*

Sleeman in his *Rambles and Recollections* complains of the ignorance which prevailed in India in regard to the economic aspects of famine; and the fact that Turgot anticipated, in the Limousin famine of 1770, the general principles finally asserted by the Indian Famine Commission of 1880 lends

(1) Famine during the administration of the East India Company.

bread and potatoes—the ordinary food of the peasantry—were not to be had.' On this occasion Raffeissen organized his first co-operative society, which brought down local prices 50 per cent. India has already advanced, in this respect, farther than Europe had gone less than two generations ago.

[1] In the Orissa famine, for instance, the Santāls starved in large numbers, because it was not known that they were peculiar in refusing to touch food cooked by Brāhmans; and a new caste, the Chattar-khai or 'kitchen-eaters,' dates from that famine.

colour to his complaint. But the East India Company really developed a famine policy, although their means of giving effect to it were small. In the Bengal famine of 1770 relief was administered, mainly in the old native way[1]. In the Agra famine of 1838 the beginnings of modern famine policy appear. The period from 1770 to 1838 was generally one of increasing knowledge, experiment, and expenditure, but progress was interrupted by wars which were themselves one of the causes of famine. All accounts of these early famines are vitiated by guesses which are still a fruitful source of controversy[2]; and there is practically no information for native territory, where famines were most frequent. Only a few general facts stand out of the mass of speculation.

Prices and food-supply.

Owing to the want of communications, prices in famine areas ran up to a level rarely reached in modern times, when normal prices are probably three times as high as they were a century ago[3]. Government prohibited the export of grain, and tried to import it and fix its price. The attempt was always costly and generally vain. From 1812 onwards the principle of non-interference with trade was adopted, but for many years bounties were given on importation.

Relief.

Relief works were first opened in Madras in 1792. The obligation to provide work for all who sought it was fully recognized for the first time in the Agra famine of 1838[4]. The relief of the helpless, who crowded into the big towns, was left to the charitable public. The largest direct expenditure on relief was about 23 lakhs in 1838. Remissions of revenue were generally made in the old native way—Government collecting what it could and leaving the rest—and were thus the measure of desolation rather than of relief.

[1] In reality this famine was administered by the Native Government. The East India Company did not assume direct management of Bengal until a few years later.

[2] The danger of building conclusions on them is illustrated by the fact that, in spite of the great mortality in the Orissa famine of 1865, the population of the affected districts, as ascertained by the 1871–2 Census, was considerably larger than the estimate made of it by the best authorities prior to the famine.

[3] Thus, in 1813, when prices in Rājputāna were 5 seers, in the Agra and Farrukhābād Districts they were never below 21 and 39 seers per rupee, respectively. In 1838, prices in the Province of Agra ranged from 16 to 10 and even 8 seers, while in Mālwā they were 50 to 60 seers per rupee. A seer is about 2 lb.

[4] This was the first occasion when a fixed famine wage was given. Relief was given on ordinary works without any special arrangements. Relief works under professional control were largely used for the first time in 1854.

The depopulation of the country is sufficient proof of terrible mortality, although any estimates of it are practically worthless. A third of the population, or 10,000,000, are said to have perished in the Bengal famine of 1770; and Colonel Baird-Smith put the death-roll of the Agra famine of 1838 at 800,000 on an estimated population of 15,500,000. Both estimates have been disputed, the former as excessive, the latter as inadequate. Mortality.

A new spirit entered into famine policy when the Government of India passed to the Crown. The famine of 1861 witnessed the first practical demonstration of sympathy by the British public, and was followed by the first famine inquiry. The mortality in Orissa in 1866 deeply stirred the public conscience, and Sir George Campbell's Commission, which followed, effectually called attention to the responsibilities of Government in times of famine. This was the beginning of a more humane policy; but it was not till 1874 that the responsibility of the state for gratuitous relief was fully recognized. (2) Famines during the administration of the Crown, before 1880.

The famine of 1861 struck parts of the Province of Agra and the Punjab, and touched Rājputāna and Cutch. The total area affected was 53,500 square miles, with an estimated population of 20,000,000; but famine is said to have been intense only between Agra and Delhi, a tract weakened by two years of irregular harvests and the military operations of the Mutiny. The autumn harvest was lost and very little of the spring harvest was sown. In 1838 remissions of revenue had been liberal, and relief had been given to the able-bodied on ordinary works managed by civil officers. In this famine remissions of revenue were small, but ten large relief works were opened under professional control; moreover the Government doubled the subscriptions of the public for the relief of the helpless. Poorhouses were opened, and respectable ladies were relieved in their own homes, for the first time, in this famine. Altogether some 33,000,000 units[1] were relieved in British territory, at a cost of about 27 lakhs, of which 9 lakhs was subscribed by the public. The mortality was estimated at $8\frac{1}{2}$ per cent. of the population in the worst districts. Famine of 1860–1.

An inquiry into this famine was conducted by Colonel Baird-Smith. His report is still of interest, as showing the advance made in general administration, small though it may appear to modern eyes. Stability of tenure and canal irrigation Colonel Baird-Smith's inquiry.

[1] In famine phraseology a 'unit' means one person relieved for one day; e.g. if 100 persons are relieved daily for a month of thirty-one days, 3,100 units will have been relieved.

had already increased the staying power of the people. Many modern principles were anticipated, particularly in regard to selection for gratuitous relief. But practice was still crude: the temporary migration of 250,000 people from the Doāb was viewed with satisfaction by this able officer.

The Orissa famine of 1865-7.

The next famine fell on the whole eastern coast from Madras upwards, reaching far inland. The total area affected was estimated at 180,000 square miles, with a population of 47,500,000; but distress was greatest in Orissa, which was at that time practically isolated from the rest of India. The people depended for food on the winter rice, and the rainfall of 1865 was scanty and ceased prematurely. Food-stocks had been depleted and soon ran short; but the gravity of the situation was not realized, the Bengal Board of Revenue being misled by defective estimates of the population requiring food and by fictitious price lists. The position was not grasped till the end of May, and then the monsoon had set in. Carriage by sea was extremely difficult, and even when grain reached the coast it could not be conveyed inland. At great cost some 10,000 tons of rice were imported, but this did not reach the people till September. Meanwhile the mortality had been very great. It was estimated that at least a million people, or one-third of the population, died in Orissa alone. The troubles of Orissa did not cease in 1866. The heavy rains of that year caused floods which destroyed the rice in low-lying lands, and in the following year relief measures were again undertaken. 'Then, as an apparent result of the reaction following the want of foresight and activity in the preceding year, the relief operations were marked by a profusion and absence of check hitherto unexampled. Altogether about 40,000 tons of rice were imported, of which the most lavish use could not dispose of half; and while it cost four times the usual price to procure, the residue had to be sold for almost nothing when the monsoon of 1867, followed by an unusually fine harvest, altogether put an end to the famine in 1868[1].' In the two years about 35,000,000 units were relieved at a cost of 95 lakhs, two-thirds of which was debitable to the expense of importing grain. Adding loss of revenue in all departments, the famine in Orissa is said to have cost the state about 1½ crores.

In Madras, in 1866, about 21,000,000 units were relieved at a cost of 12 lakhs, and revenue was remitted to the amount of 15 lakhs. Rather more than a lakh was also spent on relief works in Bombay.

[1] *Report of the Famine Commission of* 1880, Part I, paragraph 51.

The relief arrangements of the first year in Orissa were much criticized by Sir George Campbell's Commission of inquiry, particularly in regard to the poorhouses; but failure was mainly due to the actual dearth of food, which the then imperfect means of information failed to detect until too late, and the then means of communication failed to relieve when detected.

The Rājputāna famine of 1868–70.

This great famine in the east was shortly followed (1868–70) by a great famine in the west of India, which affected an area of 296,000 square miles, with an estimated population of 44,500,000[1]. The famine centred on the Native States of Rājputāna and the British territory of Ajmer. The rains came late, fell lightly, and practically stopped in August. There was an utter dearth of fodder, and in parts of water; and grain could only be imported on camels. Thus Rājputāna was landlocked in the same way as Orissa. The people emigrated in enormous numbers with their flocks and herds[2], but were reluctant to go on relief works in British territory, and many wandered till they died. Cholera broke out over the whole country, and there was practically no spring harvest. Large numbers returned to their villages in May, 1869, in the belief that the rains would be early; but the rains held off till the middle of July, and in the interval thousands died. The autumn harvest of 1869 promised well, but swarms of locusts destroyed it. The rains in September and October were heavy, and were followed by a virulent outbreak of fever. A good spring harvest was, however, secured, and the famine ended in March, 1870, after dreadful mortality. In British territory 49 lakhs was spent in direct relief; and in this famine the state spent over 7 lakhs in gratuitous relief[3]. Remissions of revenue amounted to little more than 5 lakhs; but a new departure was taken in making advances to cultivators to the amount of about 21 lakhs. In the Province of Agra 29,000,000 units were relieved at a cost of nearly 30 lakhs; but in spite of the Lieutenant-Governor's declaration (referred to on p. 478)

[1] Gujarāt, the North Deccan Districts, the Jubbulpore Division of the Central Provinces, the Agra and Bundelkhand Divisions of the United Provinces, and the Hissār Division of the Punjab were all affected. These two famines, coming so close together, find their counterpart in the famines of 1897 and 1900 almost exactly a generation later: in each case the centre of distress shifted to the west, and the rains were unusually late in the second famine year.

[2] Of 1,500,000 inhabitants of Mārwār, 1,000,000 are said to have emigrated with their cattle.

[3] In Native States relief was given on a very small scale, except in Udaipur, where 5 lakhs was spent.

as to the responsibility of District officers for saving life, the mortality was great. Immigration from Native States broke down the relief system.

The Bihār famine of 1873–4.

The lessons of Orissa and Rājputāna were still fresh, when there followed a partial failure of the rains in Bihār and in the adjacent parts of Bengal and the United Provinces. The total area affected was only 54,000 square miles, with a dense population of 21,500,000, and the failure of the rainfall was not very serious; but an immense organization was set on foot, and it was decided to save life at any cost. From first to last about 300,000,000 units were relieved (including 20,000,000 in the United Provinces) at a cost of 6¼ crores, of which nearly 4 crores were spent on the importation of grain. Altogether this famine cost the state about 6¾ crores. Financial considerations were thrown to the winds; but life was saved, and a great advance was made in administration. For the first time village inspection, the basis of modern organization, was carried out, and gratuitous relief on a large scale was given by the state. The enormous expenditure on 'a famine of unusual brevity and of no exceptional severity[1]' would probably never have been incurred had any system of agricultural information existed. The want of such a system was shown again in the following year, when, on the premature cessation of the rainfall, the Local Government proposed to renew large relief measures in Bihār. The Government of India, however, resisted the alarm; and in the result, so far from there being a famine, grain was cheaper than usual in the area of anticipated distress.

Southern India famine of 1876–8.

The famine which commenced in 1876 afflicted Southern India (Madras, Mysore, Hyderābād, Bombay) for two years, and in the second year extended to parts of the Central and United Provinces and to a small tract in the Punjab. The total area affected was 257,000 square miles, with a population of 58,500,000. Embarrassed by the large expenditure on the Bihār famine, the Government of India insisted on the imposition of proper tests in the interests of both the people themselves and the general taxpayer. In Bombay these tests drove large numbers of relief-workers to strike, and the question arose whether relief should be given to men who could, but would not, work. This was decided by the Government of India as follows: 'We say that human life shall be saved at any cost and effort'; and if it is asked what 'the general principles are by which the District officers should be guided in refusing the aid needed to preserve life, the reply must be that

[1] *Report of the Famine Commission*, 1880, paragraph 94.

there are no such principles, and that there are no circumstances in which such aid can be refused.' In Madras and Bombay the reduced, or Temple[1], wage was adopted, but eventually abandoned as insufficient except under favourable circumstances. In the United Provinces little relief was given, and the mortality was very great. Throughout India fever raged in the autumn and winter of 1878. The excess mortality in this famine is said to have been 5,250,000 in British territory alone.

Speaking generally, the administration of relief was as strict on this occasion as it had been lax in Bihār. Prices ranged very high, and owing to the absence of railways private trade was scarcely equal to the demands made on it. Throughout British India about 700,000,000 units were relieved at a cost of $8\frac{1}{3}$ crores[2]; and charitable contributions from Great Britain and the Colonies amounted to 84 lakhs.

In 1878 the whole question of relief and protection was referred to the first great Famine Commission under the presidency of Sir Richard Strachey. Starting from the principle, laid down in 1877, that the Government should spare no efforts to prevent starvation or an extremity of suffering dangerous to life, but could not attempt to prevent all suffering or to give general relief to the poorer classes of the community, the Famine Commissioners insisted that relief should be so administered as not to check the growth of thrift and self-reliance among the people, or to impair the structure of society which, resting in India upon the moral obligation of mutual assistance, is admirably adapted for common effort against a common misfortune. 'The great object,' they said, 'of saving life and giving protection from extreme suffering may not only be as well secured, but in fact will be far better secured, if proper care be taken to prevent the abuse and demoralization which all experience shows to be the consequence of ill-directed and excessive distribution of charitable relief.' They quoted Turgot to the effect that 'the best and most useful kind of alms consists in providing means of earning them,' and laid down the principles (1) that employment should be given on relief works to the able-bodied, at a wage sufficient for support, on the condition of performing a suitable task; and (2) that gratuitous relief should be given, in their villages or in poor-

The Famine Commission of 1878–80.

[1] So called after Sir Richard Temple, the Famine Commissioner for the Government of India. The wage was 1 lb. of grain *plus* 1 anna for a man, with small reductions for a woman or child.

[2] In Hyderābād and Mysore about 72,000,000 units were relieved at a cost of 72 lakhs, and revenue was remitted to the amount of 60 lakhs.

houses, to those who, after inquiry into their circumstances, were found to be unable to work. In order to regulate relief, they prescribed constant inspection of the people in their villages. As regards food-supply, they recommended non-interference with trade except in the very rare cases when it might be unequal to the demands on it. Finally, they advised that the landowning classes should be assisted by loans and by general suspensions of revenue in proportion to the general crop failure, it being a condition that proportionate relief should be given by the landowners to tenants and holders of subordinate rights in the land.

The Provisional Code and the famine wage.

These recommendations were embodied in a Provisional Famine Code. In circulating this in 1883, the Government of India laid down the fundamental principle of the famine wage. That wage is 'the lowest amount sufficient to maintain health under given circumstances. While the duty of Government is to save life, it is not bound to maintain the labouring population at its normal level of comfort. To do so would be unjust to other sections of the community, besides prolonging the period for which the labouring population would cling to the relief works.'

Provincial Codes were then drawn up, and were acted upon in the several scarcities which followed in different parts of India. These codes were first severely tested by the famine of 1896–7.

(3) Famines during the administration of the Crown, after 1880. Famine of 1896–7.

The monsoon of 1895 was weak in the Bundelkhand Districts of the Province of Agra, and the winter rains also failed. Famine was declared, and relief was commenced, early in 1896. The monsoon of 1896 was generally deficient; and the United Provinces, the Central Provinces, Berār, parts of Madras, Bombay, Bengal, the Punjab, and Upper Burma, together with portions of Rājputāna, Central India, and Hyderābād, were plunged in famine. Altogether 307,000 square miles were affected, with a population of 69,500,000, and the numbers relieved exceeded 4,000,000 at the time of greatest distress.

In British territory the area and population affected were 225,000 square miles, and 62,500,000, respectively[1]. Famine was intense in the United Provinces, the Central Provinces, Bihār, and the Hissār District of the Punjab. From first to last, 821,000,000 units were relieved at a cost of 7¼ crores. In addition, revenue was remitted and loans were given to the extent of about 1¼ and 1¾ crores. The charitable relief fund amounted to nearly 1¾ crores, of which about 1¼ crores were

[1] No complete account of relief in Native States is available.

subscribed in the United Kingdom. The famine ended, generally, when the autumn harvest of 1897 was ripe; but it was followed by heavy mortality from fever in the autumn, and by a plague of rats. The actual famine mortality in British Districts may be roughly estimated at about 750,000. This famine will be remembered for the vigorous, efficient, and economical administration in the United Provinces, and for the comparative failure of relief in the Central Provinces. The difficulties in this latter Province were, however, extraordinarily great, owing to the reluctance of the wild tribes to accept relief on ordinary terms.

The Famine Commission of 1898.

The incidents of this famine were exhaustively analysed by a Commission, presided over by Sir James Lyall, which passed the following judgement on the administration as a whole: 'We consider that, while the areas over which intense and severe distress prevailed in the famine of 1896–7 were greater than in any previous famines, the success actually attained in the relief of distress and the saving of human life was, if not complete, far greater than any that has yet been recorded in famines that are at all comparable with it in point of extent, severity, or duration; and that this result has been achieved at a cost which, when compared with the expenditure in previous famines, and with other standards which we have had before us, cannot but be regarded as very moderate.'

This Commission also made important recommendations for the future treatment of famines. In regard to the broad principles of relief administration they adhered to the recommendations of the Commission of 1880. But in details they suggested some changes, including a more liberal wage and an extension of gratuitous relief, particularly during the rains. They broke new ground in formulating rules for the relief of weavers in their own trade, for the relief of aboriginal and hill tribes, and for the management of the charitable relief fund; and they laid great stress upon the necessity for liberal remissions of land revenue. The Commissioners seem to have been impressed by events in the Central Provinces, and the general effect of their recommendations was to avoid all risks and to make relief more attractive.

The famine of 1899-1900.

Before these recommendations had been fully considered, another great famine occurred. Distress began in Ajmer in 1898 and some relief was given. The monsoon of 1899 failed generally over the west and centre of India. In the Central Provinces, Berār, Bombay, Ajmer, and the Hissār District of the Punjab, famine was acute[1]; it was intense in Rājputāna,

[1] There was also distress in small areas in Bengal, Madras, and Agra.

Baroda, Central India, Hyderābād, and Kāthiāwār. The total area affected was 475,000 square miles, with a population of 59,500,000. The Meteorological Department declared the drought to be unique. 'The mean average rainfall of India is 45 inches. In no previous famine year has it been in greater defect than 5 inches. But in 1899 the defect exceeded 11 inches.' This was for India as a whole; in particular localities there was practically no rainfall. The autumn harvest was a failure, and hardly any spring crops were sown. At the end of July, 1900, no fewer than 6,500,000 persons were receiving daily relief. The distress was aggravated, and the difficulties of administration were enormously increased, by the failure of the water-supply and fodder.

In British territory[1] 180,000 square miles with a population of 26,000,000 were affected, a smaller area and a much smaller population than in 1897; but the people in most parts had not recovered fully from the famine of two years before. The numbers relieved were far greater than in 1897. At the time of greatest relief—in this famine at the end of July—4,500,000 persons were supported by the state. Altogether about 1,140,000,000 units were relieved at a cost of 10 crores. Cattle died in millions, and the Government helped agriculturists by very large remissions of revenue and by loans which have since been mostly written off. The total cost to the state has been put at about 15 crores. The charitable relief fund reached 1½ crores, of which nearly a crore was subscribed in the United Kingdom. In addition, loans were made to Native States to the extent of 3½ crores. Although the relief was thus extraordinarily liberal, the mortality was great. The Famine Commission of 1901 thought that about one million deaths might be attributed to famine in British Districts, and that of this total at least one-fifth were caused by cholera. This was largely due to the special conditions of the famine: namely, the extreme rigour of the winter of 1899–1900, the failure and consequent pollution of the water-supply, which led to virulent outbreaks of cholera in the summer of 1900, and the extremely unhealthy autumn in 1900, uring which malarial fever attacked the rich as well

[1] The Native States conducted their own relief under the general advice of the Government of India, which lent them the services of British officers and assisted them with loans. It is impossible to give details. In some States very inadequate relief was given, and in most the mortality was great. But the Commission of 1901 was struck with the advance made by most of the Darbārs towards bringing their relief into line with the humane policy of the British Government.

s the poor. The famine ended, generally, when the autumn harvest of 1900 was ripe; but distress continued in parts of Western India for two years more.

This famine is remarkable for profuse relief in the Central Provinces, great mortality in Gujarāt, and general emigration from the Native States. In the Central Provinces the reaction from 1896 was complete: the people were all too ready to take relief (even the aboriginal tribes overcame their shyness), and the officers were anxious not to be behindhand in dealing with distress. For some months, over 20 per cent. of the total population were relieved; and the total cost of direct relief was nearly 4½ crores. In Gujarāt the people and the Government were alike unprepared: the former had been softened by a long period of prosperity, and were stunned by the blow. Their wealth was sunk largely in their cattle, and in the vain hope of saving these, they clung to their homes until it was too late. Relief of the aboriginal tribes was as difficult in Gujarāt and Khāndesh as it had been in the Central Provinces in 1897, and the result was much the same. In all Provinces the administration was hampered by crowds of immigrants from Native States, so exhausted by privation in many cases that their lives could not be saved even by the best medical care.

The Famine Commission of 1901.

A Commission, presided over by Sir Antony MacDonnell, whose own famine relief measures in the United Provinces had been so successful in 1896-7, was appointed to gather up the lessons of this famine. Their judgement on the administration as a whole was as follows: 'In certain districts . . . people in sore need of relief were denied it in the early stages of the famine, owing to defective administration; but in the main, and taking the famine period as a whole, the relief distributed was excessive. We have no doubt that the excess is to be accounted for by an imperfect enforcement of tests on relief works, by a too ready admission to gratuitous relief, and by a greater readiness on the people's part to accept relief owing to the demoralizing influences of the preceding famine.'

Impressed apparently by this demoralization, the Commission clearly restated 'the principles by which alone famine relief on a great scale can be successfully administered.' They recommended a policy of 'prudent boldness,' starting from a large and expansive plan of relief, and secured by liberal preparations, constant vigilance, and a full enlistment of non-official help. The wage-scale was revised; the minimum

wage was abolished in the case of the able-bodied, payments being made proportionate to the task performed; and provision was made for the exclusion from relief works of those who were in a position to maintain themselves. The relief system was enlarged by proposals for dealing with a fodder famine. Where differing from the Commission of 1898, this Commission reverted as a rule to the recommendations of the Commission of 1880.

Conclusion. It will thus be seen that, in the quest of the happy mean, the pendulum has been constantly on the swing; but the arc has become steadily smaller, and the relief system is gradually settling down. The main principles of relief are no longer questioned, and diversity in practice becomes less in each successive famine. The essential difficulty of state relief is deep-rooted. The reluctance of those unaccustomed to famine to accept relief, and the eagerness of those accustomed to famine to seek relief, are likely to perplex the relieving officer in the future as they have done in the past. But as establishments improve, the system will become more elastic and adaptable.

Famine Mortality. Although much ground has been gained in the long struggle with nature, and drought has been stripped of its worst horrors, the tale of suffering is still long, and the heart of the civilized world is touched by the mortality of an Indian famine. The Famine Commissions of 1880, 1898, and 1901 agree that 'no imaginable system of relief will completely meet all the various degrees of privation and suffering which a famine produces.' Pestilence is the twin-sister of famine, for the abnormal conditions of drought have from the earliest times lent themselves to disease[1]. Cholera invariably breaks out in the hot weather, and fever almost invariably succeeds in the autumn. Moreover, in every famine many persons refuse relief until

[1] It seems worth while to quote an authoritative opinion on famine mortality. 'Dysentery and diarrhoea are peculiarly famine diseases, directly caused by insufficient and unwholesome food, or by reduced powers of digestion and assimilation as the result of continued privation. Again, it is practically impossible to prevent the outbreak of cholera when large masses of men are collected together in the hot weather under famine conditions; but efficient organization and careful sanitary arrangements can stay the spread of the epidemic, and when these precautions are not taken, a considerable share, at any rate, of the resultant mortality must be deemed to have been preventible. Of fevers it can only be said that they often are in origin climatic, but that their fatality is, owing to the reduced power of the people to resist them, largely due to famine.'—*Report of the Famine Commission of* 1901.

it is too late to save them. Nevertheless, the total famine mortality since 1880 has been small compared with what it was before relief was then reduced to system. Moreover, the great majority of deaths in the two recent famines occurred generally among the very old and the very young. There has been since 1880 comparatively little of that mortality among healthy adults which was so deplorable a feature of earlier famines, a fact of which the comparatively rapid recovery in the birth rate is at once the result and the proof.

IV. Protection against Famine

The famine problem is not, however, limited to relief. 'It is of still more essential importance,' said the Secretary of State in 1878, 'to ascertain how far it is possible for Government by its action to diminish the severity of famines, or to place the people in a better condition for enduring them.' The Famine Commission of 1880 concluded that much could be done in this direction, particularly by the accumulation of accurate knowledge of the country and its economic conditions, with the ultimate object of stimulating the material prosperity of the people; and much has been done. Protective aspect of the famine problem.

Reference has already been made to the elaborate system of agricultural intelligence, but this represents but a part of progressive knowledge. Geological, mineralogical, ethnological, and linguistic surveys have been set on foot, while valuable statistics of trade are annually published and reviewed in the Department of Commerce. Vital statistics are still defective, but each successive Census marks improvement in their registration. The functions of Government have been differentiated, the branches of the administration have been specialized, and action has been taken simultaneously on many lines. System of intelligence.

Railway and irrigation works—'the best, and often the only, means of securing protection from the extreme effects of famine and drought[1]'—have always been the mainstay in building up material prosperity. From the financial point of view, these works are of two kinds, according as they are, or are not, commercially profitable, the former being called productive, the latter protective. The cost of the former is met by loans; the latter are debitable to the Famine Insurance Grant. Productive and protective railways and irrigation works.

This grant dates from the famine of 1876. A succession of famines, and a recognition of the duty of the state in regard The famine

[1] *Report of the Famine Commission of* 1880.

relief and insurance grant.

to them, induced the Government of India to provide a reserve in ordinary years to meet the obligatory and recurrent, but extraordinary, demands of famine relief. This reserve was fixed, on the basis of past expenditure, at 1½ crores annually, and was secured by fresh taxation and economy. Doubts as to the precise objects to which the grant should be devoted arose almost immediately, but were settled in 1881 by a scheme, which, in its general bearings, still obtains. The first charge on the grant is famine relief, the second protective works, and any balance is devoted to the reduction, or rather the avoidance, of debt.

The place of railway and irrigation works in famine insurance.

Experience in 1866, 1868, and 1878 had shown the imperative need for extending communications, and precedence in the policy of insurance was consequently given to the construction of protective railways, or the guarantee of interest on money borrowed for the purpose. The system of protective railways has been practically completed so far as main lines are concerned, and the Famine Commissions of 1898 and 1901 urged the now greater claims of protective irrigation works.

Railways and irrigation works as they affect material progress.

The distinction between productive and protective works is purely financial. It remains to consider the effect of railways and irrigation on material prosperity. The benefits of irrigation have never been disputed; but of late there has been a tendency in some quarters to detract from the advantages of railways. It is contended that, by equalizing prices all over India, railways extend the area of distress beyond the limits of crop failure, and that they have destroyed the habit of storing grain, which formerly served as an insurance against famine. This may be admitted, without really qualifying the overwhelming benefits of improved communications. If railways have somewhat extended the area, they have enormously reduced the intensity, of distress; and if they have discouraged the storage of grain, they have substituted 'the great reserves of the country at large for the petty reserves of individuals [1].' They have substituted famines which are of money only, for famines in which both food and money were lacking; and by giving access to large markets they have undoubtedly increased the incomes of landowners and cultivators, and enabled them to reap the benefits of high prices [2]. 'It is true,' say the Famine

[1] *Report of the Famine Commission of* 1901, paragraph 223.

[2] It may be noted that, among the reasons adduced by the Board of Revenue in 1812 against a Permanent Settlement in the Upper Provinces, was the fact that 'an exuberant harvest is, in the existing state of society here, almost as detrimental to the landholders as a scanty produce.'

Commissioners of 1901, 'that to a certain extent cultivators, who formerly stored grain, because it could be neither sold nor removed, have ceased to do so because they can sell to advantage; and that, owing to their improvidence, the money slips through their fingers. But this change in the habits of the people is a regular attendant of progress: it is merely a transient phase of a great economic movement, which makes for national prosperity.' It has become a proverb in India, as elsewhere, that 'railways make trade.'

Other efforts to increase material prosperity.

Much has been done in other departments to promote general prosperity. The land revenue has become progressively moderate in assessment, and increasingly elastic in collection. The rent law of nearly every Province in India has been revised since 1880 in favour of the cultivating classes. Loans are given by the state, at low interest and on easy terms of repayment, for land improvement and for the purchase of seed and bullocks; and attempts are being made, with the active help of the state, to start co-operative credit associations. Experiments in agricultural improvements are continuously carried on. It cannot be said that the agricultural classes have responded very largely to the efforts made to help them or to teach them to help themselves, or that those efforts have always been well devised; but experience is being steadily gained, and the cumulative effect of the action already taken is considerable.

Steadily increasing

The Famine Commissions of 1880 and 1898 both bore witness to the recuperative power of the country[1], but the best

[1] 'It is, we believe, demonstrable that the effects produced by the famine of 1876-8 on the general prosperity of the country have been less disastrous than those of former calamities. . . . The famine of 1770 resulted in widespread desolation of the most affected districts, so that we read of depopulation and ruin, the thinness of the inhabitants, many hundreds of villages entirely depopulated, half the ryots credibly reported to have perished, and a complete disorganization among the landed classes which lasted for many years. The famine of 1803 struck such a blow at the prosperity of Khāndesh and Ahmadnagar that even in 1867 the traces of its ravages were still visible in the ruins of deserted villages which had not been repopulated. In the famine of 1833 so much land went out of cultivation in the Guntūr District that even in 1850 the land revenue was only three-fourths of what it had been in 1832. In 1837, in the North-Western Provinces, the pressure was so great that the ordinary bonds of society seemed to be broken by it. In 1841 the still-deserted lands and abandoned houses in the Etāwah District bore evidence to the devastation and waste of life, and during the next five years the land revenue continued to be less by 12 per cent. than in the period preceding the famine. Colonel Baird-Smith, from whom the above quotation is made, testified that similar effects were hardly noticeable in 1860-1,

recuperative power of the country.

evidence of the fact is the rapid recovery of cultivation after a famine. The following figures give the cropped area in British Provinces[1] for the years preceding, coincident with, and following the recent famines:—

Year and Area of Famine.	Total cropped Area in Millions of Acres.		
	Year before famine.	Year of famine.	Year after famine.
1897 (Bengal, United and Central Provinces, Berār, Madras, Bombay)	180	167	183
1900 (Central Provinces, Berār, Bombay, Ajmer)	49	40	45

As the mortality of cattle was enormous in 1900, and distress continued in Bombay and Ajmer until 1902, these figures show a power of recuperation in the landowning and cultivating classes which would have been thought impossible fifty years ago.

General progress.

Nor are the evidences of material progress confined to the landowning and cultivating classes. The great increase during the last twenty years in trade and commerce, in the use of the post and the telegraph, in remittances by money orders, and in savings banks deposits; the rise in urban wages, and the expanding revenue under excise, stamps, and income tax, all testify, in different ways and in various degree, to the steady

and this he attributed to the increased power of resistance and self-support among the landowners following the introduction of long-term settlements, which dated from about 1840. Still more remarkable are the facts recorded in the agricultural statistics of Bombay and Madras for the year 1877–8. In Madras the area occupied exceeded by 50,000 acres that of 1874–5. . . . In Bombay there was an actual increase of 70,000 acres of revenue-paying occupied land in excess of the previous year.'—*Report of the Commission of* 1880, paragraph 84.

'It may be said of India as a whole that of late years, owing to high prices, there has been a considerable increase in the incomes of the land-holding and cultivating classes, and that their standard of comfort and expenditure has also risen. With a rise in the transfer value of their tenures, their credit has also expanded. During the recent famine these classes, as a rule, have therefore shown greater power of resisting famine, either by drawing on savings, or by borrowing, or by reduction of expenditure, than in any previous period of scarcity of like severity.'—*Report of the Commission of* 1898, paragraph 592.

The subject was not referred to, or discussed by, the Famine Commission of 1901.

[1] Except in the Punjab, the recorded figures for which are excluded as doubtful.

growth of general prosperity. Twenty years is a very short time in an old and conservative country like India.

The one exception.

One class alone is being left behind in the general progress, and that a large one. Agricultural labourers, as already stated, are multiplying rapidly on the margin of subsistence and beyond the requirements of agriculture, and by so doing are keeping their own wages low, while cash payments for work actually done are superseding, over large parts of India, the old customary payments of grain at each harvest. Agricultural progress will do little to improve their position. Emigration when feasible, will only temporarily postpone the pressure on the soil, unless the growth of population is checked. 'No remedy for present evils,' say the Famine Commissioners of 1880, 'can be complete which does not include the introduction of a diversity of occupations through which the surplus population may be drawn from agricultural pursuits and led to find the means of subsistence in manufactures or some such employments.' In this direction a fair start has been made. The construction of railways and irrigation works employs large numbers; and there is a growing labour market in docks and arsenals, and in the factories and commercial undertakings that are now springing up. But the numbers released from dependence on the land are as yet few in proportion to the normal increase of the rural population. Industrial development is slow, and the growth of population is quick. The country is crying for capital, and native capital is, so far, not forthcoming. 'The natural resources of India are beyond question, as is also the need for their development. In order to develop and reap the benefit of her resources, India requires, and must long continue to require, foreign capital[1].' The steady application of capital to the organization and development of industry is, indeed, the one thing needful for the gradual solution of the famine problem.

[1] *Report of Sir Henry Fowler's Currency Committee*, 1898, paragraph 36.

Bibliography

W. W. Hunter.—*Annals of Rural Bengal* (1868).

Report on the Famine of 1860–1, by Colonel R. Baird-Smith.

Report of the Bengal and Orissa Famine Commission, 1866.

Narratives of the Drought in Bengal and Bihār in 1873–4, with Minutes by Sir Richard Temple (1874).

Report of the Indian Famine Commission, 1880; ditto, 1898; ditto 1901.

Report of the Indian Irrigation Commission, 1901–3.

APPENDIX

Chronological List of Famines and Scarcities from 1769

F. = Famine. S. = Scarcity.

Year.	British territory.	Native territory*.
1769-70	F. Bihār, Northern and Central Bengal †. S. Eastern Bengal †.	
1782-3	F. Madras city and its environs. S. Bombay and its environs	F. Haidar Ali's country. S. Cutch and neighbouring country.
1783-4	S. Bihār and adjoining British Districts in United Provinces.	F. Present United Provinces, Eastern Punjab, Kashmīr, and Rājputāna.
1791-2	S. Northern Madras	F. Hyderābād, Southern Marāthā country, Deccan, Gujarāt, and Mārwār.
1802-3	. . . .	F. Deccan and Hyderābād.
1803-4	F. Province of Agra	F. Central India and Rājputāna.
1806-7	F. Central Madras.	
1812-13	S. Part of the Provinces of Agra and Madras, and Gujarāt.	F. Cutch, Kāthiāwār, and Rājputāna. S. Baroda, and parts of Gujarāt.
1823-4	F. Northern Madras. S. Gujarāt and Northern Deccan.	
1832-3	F. Northern Madras	S. Hyderābād and Southern Marāthā country.
1833-4	S. Northern Deccan, Gujarāt, and trans-Jumna Districts of the Province of Agra, including Delhi and Hissār.	S. Rājputāna, Jhānsi, and Central India.
1837-8	F. Central and trans-Jumna Districts of the Province of Agra, including Delhi and Hissār.	
1838-9	S. Gujarāt	S. Cutch and Kāthiāwār.
1844-5	S. Deccan.	
1853-5	F. Bellary District of Madras S. Adjoining Districts of Madras and the Southern Deccan.	S. Hyderābād.
1860-1	F. Upper Doāb of the Province of Agra; Delhi and Hissār Divisions of the Punjab.	F. Eastern Rājputāna. S. Cutch.
1865-6	F. Orissa (also 1867) and Bihār; Bellary and Ganjām Districts of Madras. S. The rest of the east coast; the Southern Deccan in Bombay; Western and Central Bengal.	S. Mysore and Hyderābād.
1868-70	F. Ajmer; trans-Jumna Districts of the Province of Agra; Delhi and Hissār Divisions of the Punjab.	F. Rājputāna. S. Cutch.

* The list is incomplete. For the earlier famines in Native territory no information exists; only those which came prominently to the notice of British officers have been recorded.

† These tracts, though still nominally under Native rule, were at the time under British control.

CHRONOLOGICAL LIST OF FAMINES AND SCARCITIES FROM 1769 (*continued*)

F. = Famine. S. = Scarcity.

YEAR.	British territory.	Native territory.
1868-70	S. Adjacent parts of the Province of Agra and the Punjab; Gujarāt; Northern Deccan; Northern and South-eastern Districts of the Central Provinces.	
1873-4	F. Bihār.	
	S. Adjacent strip of the United Provinces, and Bundelkhand.	
1876-7	F. Madras and Bombay . .	F. Mysore and Hyderābād.
1877-8	F. " " . .	F. " "
	United Provinces . . .	F. Kashmīr.
	S. Punjab.	
1883-4	S. Hissār and Rohtak Districts of the Punjab.	
1884-5	S. Lower Bengal; Bellary and Anantapur Districts of Madras.	
1888-9	F. Ganjām District of Madras .	F. Orissa Tributary States.
	S. Northern Bihār and Orissa.	
1890-2	S. Kumaun and Garhwāl; Ajmer.	S. Parts of Rājputāna.
1891-2	S. Bihār; the Central and Carnatic Districts of Madras; the Southern Deccan in Bombay; Upper Burma.	
1896-7	F. Madras (Circārs and Deccan); Bombay Deccan; Bengal; United Provinces; part of the Delhi Division of the Punjab; the Central Provinces, Berār.	F. Northern and Eastern Rājputāna; parts of Central India and Hyderābād.
	S. Rest of the Delhi Division, and Ferozepore and Gujrāt Districts of the Punjab; Upper Burma.	
1899-1900	F. Bombay; Central Provinces; Berār; Ajmer; Hissār District of the Punjab.	F. Hyderābād, Rājputāna, Central India, Baroda, Kāthiāwār, Cutch, and the Feudatory States of the Central Provinces, and Eastern Punjab.
	S. Parts of Madras, Bengal and Agra, and Delhi Division of the Punjab.	
1900-1	F. Gujarāt.	
	S. The Deccan and Carnatic Districts of Bombay.	
1901-2	F. Gujarāt	S. Rājputāna and parts of Central India.
	S. The Deccan and Carnatic Districts of Bombay; Ajmer.	
1902-3	S. Parts of the Chhattīsgarh and Nāgpur Divisions of the Central Provinces.	

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